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PART IV

DEPARTMENT OF THE INTERIOR

Mining Enforcement and Safety Administration

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SURFACE COAL MINES AND SURFACE WORK AREAS OF UNDERGROUND COAL MINES

Proposed Mandatory Safety Standards

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[30 CFR Part 77]

SURFACE COAL MINES AND SURFACE WORK AREAS OF UNDERGROUND COAL MINES

Proposed Mandatory Safety Standards

Notice is hereby given that in accordance with the provisions of section 101 of the Federal Coal Mine Health and Safety Act of 1969 (Pub. L. 91–173, 83 Stat. 745, 30 U.S.C. 811) and pursuant to the authority vested in the Secretary of the Interior under section 101(a) of the Act, it is proposed that Part 77, Subchapter 0, Chapter I, Title 30, Code of Federal Regulations be revised and amended as set forth below.

Section 101(a) of the Act directs the Secretary to "develop, promulgate, and revise, as may be appropriate, improved mandatory safety standards * * *." These revisions and amendments to 30 CFR Part 77 are proposed as part of a continuous review by the Mining Enforcement and Safety Administration (MESA) of existing mandatory health and safety standards for our nation's coal mines. In accordance with section 101(c) of the Act, public meetings were held during the months of November and December 1974 and February 1975 in Pittsburgh, Pennsylvania; Charleston, West Virginia; Evansville, Indiana; Denver, Colorado; Hazelton, Pennsylvania; and Birmingham, Alabama for the purpose of discussing MESA's preliminary draft of proposed revisions and amendments. These proposed revisions and amendments are based on the voluminous comments received from industry and labor representatives at the public meetings, and on experience and technical expertise within MESA.

In numerous cases the proposed revisions and amendments clarify ambiguities in existing mandatory safety standards, and some subparts and sections have been reorganized to facilitate their use by operators and MESA inspectors. Other standards are completely revised. Because of the extent of the revisions proposed to be made in Part 77, this preamble does not attempt to explain each one in detail. Rather, selected major revisions are highlighted below. Standards that have recently been proposed or promulgated are not affected by this proposal, and they are also identified below.

SUBPART A—GENERAL

(1) Under § 77.2, "Definitions", terms which have been redefined or added include:

"Blasting agents" which has been redefined to mean any material or mixture, consisting of fuel and oxidizer, intended for blasting, and not otherwise classified as an explosive by the Department of Transportation, provided that the finished product, as mixed for use or shipment, cannot be initiated by a No. 8 detonator when unconfined. (§ 77.2(d)), and

"Charged hole" which has been defined to mean any hole containing explosives, or blasting agents with a primer. (§ 77.2(l))

SUBPART B—QUALIFIED AND CERTIFIED PERSONS

(1) Subpart B is not affected by this proposed rulemaking.

SUBPART C—SURFACE INSTALLATIONS AND EQUIPMENT

(1) The heading of Subpart C is changed to specifically refer to "Equipment". This change is made to remove any confusion which may have previously existed as to the scope of Subpart C.

(2) Construction, installation and maintenance requirements for ladders are expanded, and standards for scaffolding have been adopted. (§§ 77.206 and 77.206–1)

(3) Average illumination intensities are specified for interiors and exterior work areas of structures and facilities; slopes, tunnels and shafts; and self-propelled equipment. (§ 77.207)

(4) Light measuring instruments and methods of measurement are specified. (§ 77.207–1)

(5) The transportation, storage, use and maintenance of liquefied and non-liquefied compressed gas cylinders are now covered. (§§ 77.208–1—77.208–4)

(6) Rigging equipment standards have been added, which include tables to assist in determinations such as maximum working load limits and rated capacities. (§ 77.210–1)

(7) Regulations regarding refuse piles and impounding structures are not affected by this proposed rulemaking. (§§ 77.214–77.217)

SUBPART D—THERMAL DRYERS

(1) Thermal dryer bypass stacks are required to be fitted with a clean-out door or other effective means to permit removal of material. (§ 77.302)

(2) Requirements for checking and cleaning dryer chamber drop-out doors are added. (§ 77.303)

(3) Explosion release vents are required to be checked by manual operation at intervals not exceeding 90 days. (§ 77.304)

SUBPART E—SAFEGUARDS FOR MECHANICAL EQUIPMENT

(1) Standards for power operated hand-held tools are added. (§ 77.402–1)

(2) Regulations regarding falling object protective structures (FOPS) and rollover protective structures (ROPS) are not affected by this proposed rulemaking. (§§ 77.403—77.403b)

(3) Additional requirements for welding operations have been included. (§ 77.408)

(4) Rubber tired front-end loaders and dozers purchased after the effective date of this section will be required to be equipped with parking and emergency stopping systems. (§ 77.410)

(5) Tire and rim repair standards have been added. (§ 77.410–1)

(6) New standards covering marine operation and equipment have been added. (§ 77.414)

SUBPART F—ELECTRICAL EQUIPMENT—GENERAL

(1) The electrical subparts (F, G, H, I, J, and S) have been reorganized so that all the specific requirements relating to a specific type of circuit are within a single subpart. As proposed, Subpart F contains the general requirements applicable to all circuits.

(2) Sections 77.500 and 77.501 are consolidated, and gloves are required when testing and troubleshooting on low- and medium-voltage circuits. (§ 77.500)

(3) Electric powered hand-held tools are considered electrical equipment for the purposes of Part 77. (§ 77.502–2)

(4) Ampacity requirements and ampacity ratings are specified for specific types of circuits and conductors respectively. (§§ 77.503–1 and 77.503–2)

(6) Voltage limitations have been added for motor control circuits that are external to the motor controller enclosure. (§ 77.507)

(7) Guarding requirements for all low- and medium-voltage electric equipment have been specified. (§ 77.512)

(8) MESA's interpretation of the National Electrical Code as applied to hazardous locations has been specified. (§§ 77.516–1 through 77.516–4)

(9) Requirements for the installation of electric wiring and equipment have been added. (§ 77.517)

(10) New stationary electric utilization equipment is required to have an identifying nameplate. (§ 77.518)

SUBPART G—CIRCUITS TO PORTABLE AND SELF-PROPELLED ELECTRIC EQUIPMENT

(1) Subpart G defines trailing cable circuit, trailing cable, feeder cable circuit and portable feeder cable and specifies short-circuit, overload and ground fault protection requirements. (§§ 77.600—77.602–1)

(2) Fail safe ground check circuit requirements are modified to allow impedence monitoring of grounding circuits. Ground check circuits other than fail safe ground check circuits or without ground check wires may be approved by the Assistant Administrator—Technical Support. (§§ 77.603—77.603–2)

(3) Requirements are added for testing of circuit breakers protecting trailing cable circuits and feeder cable circuits. (§§ 77.604 and 77.604–1)

(4) Locations for disconnecting devices are specified. (§ 77.605)

(5) Ampacity requirements and ampacity ratings for trailing cable circuits and feeder cable circuits are specified. (§§ 77.606 and 77.606–1)

(6) Shielding is required for new low- and medium-voltage trailing cables and portable feeder cables which supply power to three-phase equipment. (§ 77.607)

(7) Connections shall not be made while cables are energized at more than 150 volts. (§ 77.614)

SUBPART H—DIRECT CURRENT CIRCUITS

(1) The requirements for grounding have been moved to the appropriate subpart for each type of circuit.

(2) Proposed Subpart H contains provisions pertaining exclusively to direct current circuits.

(3) Ground fault protection is required for resistance grounded and solidly grounded direct current circuits. (§ 77.700(a))

(4) Ground fault protection or ground fault indication is required for ungrounded direct current circuits. (§ 77.700(b))

SUBPART I—HIGH-VOLTAGE ALTERNATING CUURENT CIRCUITS

(1) Ground fault protection is required for resistance grounded and solidly grounded high-voltage circuits supplying power to stationary equipment. (§ 77.800(a))

(2) Ground fault protection or ground fault indication is required for ungrounded high-voltage circuits. (§ 77.800(b))

(3) System and enclosure grounding is specified for high-voltage systems supplying power to stationary equipment. (§ 77.802)

(4) Criteria is established for allowing earth as a grounding conductor. (§§ 77.802–2 and 77.802–3)

(5) Requirements are established for guarding high voltage equipment, conductors, cables and parts. (§ 77.804)

(6) Higher clearances are required in areas where dump trucks operate under high-voltage powerlines (§ 77.805–3)

(7) Proximity warning devices are required for self-propelled equipment with booms and masts which can extend higher than 15 feet above ground. (§ 77.805–4).

SUBPART J—LOW- AND MEDIUM-VOLTAGE ALTERNATING CURRENT CIRCUITS

(1) Ground fault protection is required for resistance grounded, solidly ground and ungrounded low- and medium-voltage circuits supplying power to stationary equipment. (§ 77.900)

(2) System and enclosure grounding is specified for low- and medium-voltage systems supplying power to stationary equipment. (§ 77.902)

SUBPART K—GROUND CONTROL

(1) Detailed ground control plans are required to be approved by MESA and adopted by the operator. (§ 77.1000)

(2) Standards regarding loose material, box cuts, benches, and scaling of highwalls are now covered within the approved ground control plan and are therefore dropped as individual sections. (§§ 77.1000—77.1000–5)

(3) Highwalls sloping into working areas are required to be examined by a certified person within two hours before each operating shift. (§ 77.1001)

SUBPART L—FIRE PROTECTION

(1) Subpart L is not affected by this proposed rulemaking.

SUBPART M—MAPS

(1) Mine maps are required to be revised and supplemented, and to be kept up-to-date by temporary notations. (§ 77.1200–1)

(2) A final certified mine map must be filed within 60 days by an operator when he permanently closes or abandons a coal mine. (§ 77.1203)

SUBPART N—EXPLOSIVES AND BLASTING

(1) Magazine location requirements include locating the magazine at distances from certain structures and facilities as specified for "inhabited buildings" in the "American Table of Distances for Storage of Explosives." (§ 77.1301(a)(2))

(2) At least two screened ventilation openings are required for over-the-road. drop-off vans containing blasting agents when the van is serving as a storage facility. (§ 77.1304(1))

(3) Restrictions are placed on certain work activities conducted within the blasting area containing charged holes. (§ 77.1308(g))

(4) Blasting is prohibited after dark. (§ 77.1308(i))

SUBPART O—HOISTING, ELEVATORS AND MANLIFTS

(1) Subpart O coverage has been extended to elevators and manlifts.

(2) Requirements covering overspeed, overtravel and automatic stop controls, and brakes have been modified. (§§ 77.1401—77.1401–4)

(3) Wire rope and wire rope attachment removal criteria have been adopted. (§ 77.1402–1)

(4) Communication and signaling requirements are added. (§§ 77.1405 and 77. 1405–1)

SUBPART P—AUGER MINING

(1) The unnecessary requirement for oxygen deficiency testing at auger operations is dropped. (§ 77.1501)

(2) Methane detectors are required to be available at each auger machine. (§ 77.1501(c))

(3) Persons, including the machine operator, are prohibited from being stationed in direct line with the borehole during augering. (§ 77.1504)

(4) Auger holes must be blocked within a specified time and distance. (§ 77.1505)

SUBPART Q—LOADING, HAULAGE, STRIPPING, DRILLING AND RECLAMATION

(1) The scope of this subpart has been expanded to include stripping, drilling and reclamation as well as loading and haulage.

(2) The subpart has been reorganized so that general provisions and transportation of persons regulations are followed by detailed installation and operation regulations for aerial tramways (§ 77.1603), conveyors (§ 77.1604), railroad trains (§ 77.1605), rubber tire and crawler mounted mobile equipment (§ 77.1606) and dumping facilities (§ 77.1607).

(3) Only maintenance men may ride in empty buckets on aerial tramways. (§ 77.1062)

(4) All self-propelled rail haulage equipment must have hydraulic brakes, pneumatic brakes or dynamic braking in addition to manual brakes, each capable of stopping and holding the maximum load. (§ 77.1605(e))

(5) Car droppers shall not ride on the front of moving trips or on the front of a single car which is being dropped. (§ 77.1605(n))

(6) Berms or guards are required on the outer banks of elevated roadways or specified conditions must be met in lieu of providing berms. (§ 77.1606(g))

(7) All new bridges must be sufficiently strong and at least one and one-half times the width of the widest vehicle which regularly uses the bridge. (§ 77.1606(h))

SUBPART R—MISCELLANEOUS

(1) All supervisory employees are required to have first-aid training and retraining. (§§ 77.1703–77.1705)

(2) Requirements for first-aid training and retraining for non-supervisory miners have been deleted from Subpart R and were proposed as Subpart U-Training and Retraining of Miners on July 29, 1976 (41 FR 31556).

(3) Protective clothing requirements have been specified in greater detail for face and eye protection, hard hats, safety belts, and seatbelts. (§§ 77.1710)

(4) Requirements for distinctively colored hard hats for newly employed miners are not affected by this proposed rulemaking. (§ 77.1710–1)

SUBPART S—TROLLEY CIRCUITS

(1) Miximum trip currents and trip times have been specified for circuit breakers protecting trolley circuits. (§§ 77.1800–1 and 77.1800–2)

(2) Requirements for testing of circuit breakers protecting trolley circuits have been added. (§ 77.1800–4)

(3) Training requirements for persons who repair energized trolley wires have been specified. (§ 77.1803–1)

SUBPART T—SLOPE AND SHAFT SINKING

(1) Standards affecting filing, approval and modification of a slope and shaft plan have been added. Additional information to be included within the plan is also required. (§§ 77.1900–77.1900–4)

(2) Wire rope and wire rope attachment removal criteria have been adopted. (§ 77.1903)

(3) When persons are transported by a hoist or endangered thereby, the hoist must meet the requirements of Subpart O of this part. This includes the requirements for two independent brakes. (§ 77.1905)

SUBPART U—TRAINING AND RETRAINING OF MINERS

Subpart U was proposed in the FEDERAL REGISTER for July 29, 1976. (41 FR 31556). That proposal is not affected by this proposed rulemaking.

SUBPART V—STRUCTURAL ERECTION

(1) New requirements for structural erection have been added. The primary source used in developing these standards was the Occupational Safety and Health Administration (OSHA) regulations for similar construction.

Interested persons may submit written comments, suggestions, data and objec-

tions to the proposed standards stating the grounds for such objections and requesting a public hearing, to the Administrator, Mining Enforcement and Safety Administration, Department of the Interior, Room 618, Ballston Tower No. 3, 4015 Wilson Boulevard, Arlington, Virginia 22203, no later than February 28, 1977.

NOTE.—The Department of the Interior has determined that this document does not contain a major proposal requiring preparation of an Inflation Impact Statement under Executive Order 11821 and OMB Circular A-107.

Date: January 6, 1977.

WILLIAM L. FISHER,
Assistant Secretary of the Interior.

It is proposed that Part 77, Subchapter O, Chapter I, Title 30, Code of Federal Regulations be amended as follows:

1. The following entries in the table of controls are revised:

Subpart A—General

Sec.	
77.1	Scope.
77.2	Definitions.
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Subpart C—Surface Installations and Equipment

77.200	Surface installations; equipment; general.
77.201	Methane content in surface installations.
77.201–1	Tests for methane; qualified person; use of approved device.
77.201–2	Methane accumulations; change in ventilation.
77.202	Coal and coal dust accumulations in surface installations.
77.203	Use of material or equipment overhead; safeguards.
77.204	Openings in surface installations and equipment; safeguards.
77.205	Travelways at and on surface installations and equipment.
77.206	Ladders and scaffolding; construction; installations; maintenance.
77.206–1	Scaffolding; general.
77.207	Illumination.
77.207–1	Light measuring instruments and methods of measurement.
77.208	Storage of materials; general.
77.208–1	Transportation of liquefied and nonliquefied compressed gas cylinders.
77.208–2	Storage of liquefied and nonliquefied compressed gas cylinders.
77.208–3	Use of liquefied and nonliquefied compressed gas cylinders.
77.208–4	Maintenance and tests of liquefied and nonliquefied compressed gas cylinders; accessories and equipment.
77.208–5	Exemption of small low-pressure gas cylinders containing nonflammable or nonexplosive gas mixtures.
77.209	Surge and storage piles.
77.210	Hoisting of materials.
77.210–1	Rigging equipment for material handling.
77.211	Draw-off tunnels; stockpiling and reclaiming operations; general.
77.211–1	Continuous methane monitoring device; installation and operation; automatic deenergization of electric equipment.
77.212	Draw-off tunnel ventilation fans; installation.
77.213	Draw-off tunnel escapeways.
•	• • • • •
77.218	Incorporation by reference.

Subpart D—Thermal Dryers

77.300	Thermal dryers; general.
77.301	Dryer heating units; operation.
77.302	Bypass stacks.
77.303	Dryer chamber drop-out doors.
77.304	Explosion release vents.
77.305	Access to drying chambers, hot gas inlet chambers and ductwork; installation and maintenance.
77.306	Fire protection.
77.307	Thermal dryers; location and installation; general.
77.308	Visual check of system equipment.
77.308–1	Control stations; location.
77.309	Control panels.
77.310	Alarm devices.
77.311	Fail safe monitoring systems.
77.312	Wet-coal feedbins; low-level indicators.
77.313	Automatic temperature control instruments.
77.314	Thermal dryers; examination and inspection.
77.315	Incorporation by reference.

Subpart E—Safeguards for Mechanical Equipment

77.400	Mechanical equipment guards.
77.401	Stationary grinding machines; protective devices.
77.402	Hand-held power tools; safety devices.
77.402–1	Power operated hand-held tools.
•	• • • •
77.404	Portable, self-propelled and stationary machinery.
77.405	Performing work from a raised position; safeguards.
77.406	Drive belts.
77.407	Power-driven pulleys.
77.408	Welding operations.
77.409	Shovels, draglines and tractors.
77.410	Self-propelled equipment; automatic warning devices and braking systems.
77.410–1	Tires and rim repair.
77.411	Compressed air and boilers; general.
77.412	Compressed air systems.
77.413	Boilers.
77.414	Marine operation and equipment.
77.415	Incorporation by reference.

Subpart F—Electric Circuits and Equipment—General

77.500	Electric power circuits and electric equipment; deenergization.
77.501	Electric circuits and equipment; maintenance.
77.502	Electric circuits and equipment; examination and testing.
77.502–1	Electric powered hand-held tools.
77.503	Power conductors; capacity and insulation.
77.503–1	Power conductors; ampacity requirements.
77.503–2	Power conductors; ampacity ratings.
77.504	Electrical connections, splices and insulation.
77.504–1	Repair of damaged conductors.
77.505	Cable fittings; suitability.
77.506	Electric equipment; short-circuit and overload protection.
77.507	Electric equipment; switches.
77.508	Electrical rating; switches, fuses, circuit breakers and controllers.
77.509	Identification.
77.510	Lightning arresters for ungrounded exposed power conductors, control lines and communication wires.
77.511	Resistors; location and guarding.
77.512	Guarding of electric equipment.
77.513	Insulating mats.
77.514	Switchboards; passageways and clearance.
77.515	Power conductors, signals conductors and control circuit conductors; insulation and guarding.
77.516	Electric wiring and equipment; installation and maintenance.
77.516–1	Class I hazardous locations; surface facilities.
77.516–2	Electric wiring and equipment in Class I hazardous locations.
77.516–3	Class II hazarodus locations; surface facilities.
77.516–4	Electric wiring and equipment in Class II hazardous locations.
77.517	Protection of electric wiring and equipment.
77.518	Equipment marking.
77.519	Low-resistance grounding medium.
77.520	Ground wire.
77.521	Grounding conductor.
77.522	Guy wires; grounding.
77.523	Use of grounding connectors.
77.524	Protection other than grounding.
77.525	Incorporation by reference.

Subpart G—Circuits to Portable and Self-Propelled Electric Equipment

77.600	Definitions.
77.601	Trailing cable circuits; protection.
77.601–1	Dual element fuses; trailing cable circuits.
77.602	Feeder cable circuits; protection.
77.602–1	Dual element fuses; feeder cable circuits.
77.603	Ground check circuits.
77.603–1	Ground check circuits other than than fail safe ground check circuits; approval.
77.603–2	Ground check circuits not employing a ground check wire; approval.
77.604	High-voltage circuit breakers; examination, testing and adjustment.
77.604–1	Low- and medium-voltage circuit breakers; record of examination, testing and adjustment.
77.604–2	Qualified person.
77.604–3	High-, medium- and low-voltage circuit breakers; record of examination, testing and adjustment.
77.605	Disconnecting devices.
77.606	Trailing cable circuits and feeder cable circuits; ampacity requirements.
77.606–1	Trailing cable circuits and feeder cable circuits; ampacity ratings.
77.607	Trailing cables and portable feeder cables; requirements.
77.608	Trailing cables and portable feeder cables; splices, insulation and repair.
77.609	Securing of trailing cables and portable feeder cables.
77.610	Mechanical protection of trailing cables and portable feeder cables.
77.611	Energized trailing cables and portable feeder cables; handling.
77.612	Cable couplers; requirements.
77.613	Cable connection boxes; requirements.
77.614	Trailing cables and portable feeder cables; connections.
77.615	Incorporation by reference.

Subpart H—Direct Current Circuits

Sec.
77.700 Protection of direct current circuits.
77.700–1 Short-circuit and overload protection; requirements.
77.700–2 Ground-fault protection; requirements.
77.700–3 Ground-fault indicator; requirements.
77.701 Direct current systems; system and enclosure grounding.
77.702 Incorporation by reference.

Subpart I—High-Voltage Alternating Current Circuits

77.800 Protection of high-voltage alternating current circuits.
77.800–1 Short-circuit and overload protection; requirements.
77.800–2 Ground-fault protection; requirements.
77.800–3 Ground-fault indicator; requirements.
77.801 High-voltage alternating current systems supplying power to portable or self-propelled equipment; system and enclosure grounding.
77.801–1 Grounding resistors; portable and self-propelled equipment.
77.801–2 Grounding medium, portable and self-propelled equipment.
77.802 High-voltage alternating current systems supplying power to stationary equipment; system and enclosure grounding.
77.802–2 Earth as a grounding conductor.
77.803 Connection of single-phase loads.
77.804 Guarding of high-voltage equipment, conductors, cables and parts.
77.804–1 Performing work in proximity to high-voltage conductors and parts.
77.805 High-voltage powerlines; clearance above ground.
77.805–1 Booms and masts; minimum distance from high-voltage powerlines.
77.805–2 Movement of equipment; minimum distance from high-voltage powerlines.
77.805–3 Operation of dump trucks under high-voltage powerlines.
77.805–4 Booms and masts; warning devices.
77.806 Work on high-voltage powerlines; deenergization and grounding.
77.806–1 Work on high-voltage powerlines.
77.806–2 Repairs on energized high-voltage powerlines.
77.806–3 Repairs on energized high-voltage powerlines; reporting.
77.806–4 Simultaneous repairs.
77.806–5 Protective equipment; installation and use.
77.806–6 Protective equipment; design, manufacture and testing.
77.806–7 Protective equipment; inspection and storage.
77.806–8 Use of grounded messenger wires; ungrounded systems.
77.806–9 Metal measuring tapes and ropes.
77.807 Operating disconnecting devices.
77.807–1 Platforms at disconnecting devices.
77.808 Visual disconnecting devices.
77.809 Movement of high-voltage portable substations, transformers and switchgear.
77.810 Incorporation by reference.

Subpart J—Low- and Medium-Voltage Alternating Current Circuits

77.900 Protection of low- and medium-voltage alternating current circuits.
77.900–1 Short-circuit and overload protection; requirements.
77.900–2 Ground-fault protection; requirements.
77.900–3 Ground-fault indicator; requirements.
77.901 Low- and medium-voltage alternating current systems supplying power to portable or self-propelled equipment; system and enclosure grounding.
77.901–1 Grounding resistors; portable and self-propelled equipment.
77.902 Low- and medium-voltage alternating current systems supplying power to stationary equipment; system and enclosure grounding.
77.902–1 Grounding resistors; stationary equipment.
77.903 Connection of single-phase loads.
77.904 Incorporation by reference.

Subpart K—Ground Control

77.1000 Highwalls, pits and spoil banks; plan.
77.1000–1 Filing of ground control plan.
77.1000–2 Mines with plans on file on the effective date of this section.
77.1000–3 Mines without plans on file on the effective date of this section.
77.1000–4 Revision in ground control plans prior to approval.
77.1000–5 Modification of approved ground control plans.
77.1000–6 Information required in ground control plans.
77.1001 Ground control; inspection and maintenance; general.
77.1002 Highwalls; men working.
77.1003 Drilling equipment; general.
77.1004 Relocation of drills; safeguards.
77.1005 Drill; operation.
77.1006 Collaring holes.
77.1007 Drill holes; guarding.
77.1008 Jackhammers; operation; safeguards.
77.1009 Air drills; safeguards.

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Subpart M—Maps

77.1200 Mine map.
77.1200–1 Temporary notations, revisions and supplements.
77.1201 Certification of mine map.
77.1202 Availability of mine map.
77.1203 Mine closure; filing of map with Secretary or his representative.

Subpart N—Explosives and Blasting

77.1300 Explosive material; general.
77.1301 Magazines; location.
77.1302 Magazine; storage.
77.1303 Persons permitted to use explosives.
77.1304 Transport of explosives or blasting agents.
77.1305 Priming of explosives or blasting agents.
77.1306 Firing of explosive charges.
77.1307 Detonating cord.
77.1308 Blasting area.
77.1309 Misfires and damaged explosives or blasting agents.
77.1310 Blasting agents; special provisions.
77.1311 Incorporation by reference.

Subpart O—Hoisting, Elevators and Manlifts

77.1400 Hoists and other hoisting devices.
77.1401 Automatic controls and brakes.
77.1401–1 Overspeed controls.
77.1401–2 Overtravel controls.
77.1401–3 Automatic stop controls.
77.1401–4 Brakes.
77.1401–5 Indicators.
77.1402 Rated capacity.
77.1402–1 Wire ropes and wire rope attachments.
77.1402–2 Maximum load; posting.
77.1402–3 Bridle chains or cables.
77.1403 Inspection and maintenance.
77.1404 Qualified hoistman.
77.1405 Communications.
77.1405–1 Standard signaling code.
77.1406 Elevators.
77.1407 Manlifts.
77.1408 Incorporation by reference.

Subpart P—Auger Mining

77.1500 Auger mining; planning.
77.1501 Auger mining; inspections.
77.1502 Auger holes; restriction against entering.
77.1503 Auger equipment; overhead protection.
77.1504 Auger equipment; operation.
77.1505 Auger holes; blocking.

Subpart Q—Loading, Haulage, Stripping, Drilling and Reclamation

77.1600 Loading, haulage, stripping, drilling and reclamation areas; general.
77.1601 Transportation of persons; restrictions.
77.1602 Use of aerial tramways to transport persons.
77.1603 Aerial tramways, installations; operations.
77.1604 Conveyors; installations; operations.
77.1605 Railroad trains; installations; operations.
77.1606 Rubber tire and crawler mounted mobile equipment; installations; operations.
77.1607 Dumping facilities.

Subpart R—Miscellaneous

77.1700 Communications in work areas.
77.1701 Emergency communications; requirements.
77.1702 Arrangements for emergency medical assistance and transportation for injured persons; reporting requirements; posting requirements.
77.1703 First aid training; supervisory employees.
77.1704 First aid training program; retraining of supervisory employees.
77.1705 First aid training program; requirements.
77.1706 First aid equipment; locations; requirements.
77.1707 Safety program for supervisory employees.
77.1708 Distribution of safety regulations.
77.1709 [Reserved]
77.1710 Protective clothing; requirements.

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77.1711 Smoking prohibition.
77.1712 Reopening mines; notification; inspection prior to mining.
77.1713 Daily inspection of surface working areas and installations; certified persons; reports of inspection.
77.1714 Incorporation by reference.

Subpart S—Trolley Circuits

77.1800 Protection of trolley circuits.
77.1800–1 Short-circuit protection; requirements.
77.1800–2 Ground-fault protection; requirements.
77.1800–3 Reclosing circuit breakers; requirements.
77.1800–4 Circuit breakers and associated devices; test and adjustment requirements.

Sec.
77.1801 Trolley wires and trolley feeder wires; support.
77.1802 Cutout switches.
77.1803 Repairs to energized trolley wires.
77.1803-1 Repairs to energized trolley wires; training.
77.1803-2 Protective gloves; inspection.
77.1804 Incorporation by reference.

Subpart T—Slope and Shaft Sinking

77.1900 Slopes and shafts; plan.
77.1900-1 Filing of a slope and shaft plan.
77.1900-2 Approval of plans.
77.1900-3 Information required in slope and shaft plan.
77.1900-4 Modification of approved slope and shaft plans.
77.1901 Preshift and onshift inspections.
77.1901-1 Methane and oxygen deficiency tests; approved devices.
77.1902 Drilling and mucking operations.
77.1903 Hoists and hoisting.
77.1904 Communications between slope and shaft bottoms and hoist operators.
77.1905 Hoist safeguards; general.
77.1906 Hoists; inspection and maintenance.
77.1907 Hoist construction; general.
77.1908 Hoist installations; use.
77.1908-1 Hoist operation; qualified hoistman.
77.1909 Explosives and blasting; use of permissible explosives and shot-firing units.
77.1909-1 Use of nonpermissible explosives; approval.
77.1909-2 Use of nonpermissible shot-firing device.
77.1910 Explosives and blasting; general.
77.1911 Ventilation of slopes and shafts.
77.1912 Ladders and stairways.
77.1913 Fire-retardant wood.
77.1914 Electrical equipment.
77.1915 Storage and handling of combustible materials.
77.1916 Welding, cutting and soldering; fire protection.
77.1917 Incorporation by reference.

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Subpart V—Structural Erection

77.3000 Structural erection; general.
77.3001 Steel erection; flooring requirements.
77.3001-1 Structural steel assembly.
77.3001-2 Steel erection; bolting, riveting, fitting-up and plumbing-up.
77.3002 Concrete, concrete forms and shoring; general.
77.3002-1 Forms and shoring.

AUTHORITY: Sec. 101, Pub. L. 91-173, 83 Stat. 745 (30 U.S.C. 811).

2. Subpart A is revised as follows:

Subpart A—General

§ 77.1 Scope.

This Part 77 sets forth mandatory safety standards for surface coal mines and for the surface work areas of underground coal mines.

§ 77.2 Definitions.

For the purpose of this Part 77, the term:

(a) "Active workings" means any place in a coal mine where miners are normally required to work or travel;

(b) "Barricaded" means to obstruct passage of persons and vehicles;

(c) "Berm" means a pile or mound of material capable of restraining a vehicle;

(d) "Blasting agents" means any material or mixture, consisting of fuel and oxidizer, intended for blasting, and not otherwise classified as an explosive by the Department of Transportation in 49 CFR §§ 173.53, 173.88 and 173.100, revised as of October 1, 1975, provided that the finished product, as mixed for use or shipment, cannot be initiated by a No. 8 detonator when unconfined;

(e) "Blasting area" means the area near blasting operations in which concussion or flying material can reasonably be expected to cause injury;

(f) "Blasting cap" means a detonator which is initiated by a safety fuse;

(g) "Blasting circuit" means the electrical circuit used to fire one or more electric blasting caps;

(h) "Certified" or "registered" as applied to any person means a person certified or registered by the State in which the coal mine is located to perform duties prescribed by this Part 77, except that, in a State where no program of certification or registration is provided or where the program does not meet at least minimum Federal standards established by the Secretary, such certification or registration shall be by the Secretary;

(i) "Charged hole" means any hole containing explosives, or blasting agents with a primer;

(j) "Delay connector" means a nonelectric short interval delay device for use in delaying blasts which are initiated by detonating cord;

(k) "Detonating cord" means a flexible cord containing a solid core of high explosives;

(l) "Detonator" means any device containing a detonating charge that is used to initiate an explosive and includes but is not limted to blasing caps, electric blasting caps, and non-electric instantaneous or delay blasting caps;

(m) "Electric blasting cap" means a detonator designed for and capable of being initiated by means of an electric current;

(n) "Electrical grounding" means to connect with the ground to make the earth part of the circuit.

(o) "Explosive" means either any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion; or, any compound, mixture, or device that is classified as an explosive by the Department of Transportation in 49 CFR §§ 173.53, 173.88 and 173.100, revised as of October 1, 1975;

(p) "Flash point" means the minimum temperature at which sufficient vapor is released by a liquid or solid to form a flammable vapor-air mixture at atmospheric pressure;

(q) "Low-voltage" means up to and including 660 volts, "medium-voltage" means voltages from 661 to 1,000, and "high-voltage" means more than 1,000 volts;

(r) "Magazine" means a facility for the storage of explosives, blasting agents or detonators;

(s) "MESA" means the United States Department of the Interior, Mining Enforcement and Safety Administration;

(t) "Misfire" means the complete or partial failure of a blasting charge to explode as planned;

(u) "Non-electric instantaneous or delay blasting cap" means a detonator with or without an integral delay element and capable of being initiated by a flexible cord containing explosive material;

(v) "Primer" means a unit, package or cartridge of explosives used to initiate other explosives or blasting agents, and which contains:

(1) A detonator, or

(2) Detonating cord when assembled with the unit, package or cartridge of explosives at the time of use;

(w) "Qualified person" means, as the context requires,

(1) An individual deemed qualified by the Secretary and designated by the operator to make tests and examinations required by this Part 77; and,

(2) An individual deemed, in accordance with the minimum requirements established by the Secretary, qualified by training, education, and experience, to perform electrical work, to maintain electrical equipment, and to conduct examinations and make tests of all electrical equipment;

(x) "Safety can" means an approved container, of not over 5 gallons capacity, having a spring-closing lid and spout cover;

(y) "Safety fuse" means a flexible cord containing an internal burning medium by which fire is conveyed at a continuous and uniform rate for the purpose of firing blasting caps; and

(z) "Secretary" means the Secretary of the Interior or his delegate.

Subpart C—Surface Installations and Equipment

3. In Subpart C, §§ 77.200 through 77.213 are revised as follows:

§ 77.200 Surface installations; equipment; general.

All mine structures, enclosures, equipment, and other facilities (including coal preparation plants, facilities used in the work of preparing coal, construction areas, offices, shops, garages and laboratories) shall be maintained in good repair to prevent accidents and injuries to miners.

§ 77.201 Methane content in surface installations.

The methane content in the air of any structure, enclosure or other facility shall be less than 1.0 volume per centum.

§ 77.201-1 Tests for methane; qualified person; use of approved device.

Tests for methane in structures, enclosures, or other facilities in which coal is handled or stored shall be made by an approved methane monitor or by a qualified person with a methane detector or other device, approved by the Secretary, at least once during each operating shift, and immediately prior to any repair

work in which welding or an open flame is used, or a spark may be produced.

§ 77.201–2 Methane accumulations; change in ventilation.

If, at any time, the air in any structure, enclosure, or other facility contains 1.0 volume per centum or more of methane, changes or adjustments in the ventilation of such installation shall be made at once so that the air shall contain less than 1.0 volume per centum of methane.

§ 77.202 Coal and coal dust accumulations in surface installations.

Coal and coal dust in the air of, or in, or on the surfaces of structures, enclosures, or other facilities shall not be allowed to exist or accumulate in dangerous amounts.

§ 77.203 Use of material or equipment overhead; safeguards.

Where overhead repairs are being made at surface installations or on surface equipment and equipment or material is taken into such overhead work areas, adequate protection shall be provided for all persons working or passing below the overhead work areas.

§ 77.204 Openings in surface installations and equipment; safeguards.

Openings in surface installations and equipment through which men or material may fall shall be protected by railings, barriers, covers or other protective devices.

§ 77.205 Travelways at and on surface installations and equipment.

(a) Safe means of access shall be provided and maintained to all working places.

(b) Travelways and platforms or other means of access to areas where persons travel or work shall be kept clear of all extraneous material and other stumbling or slipping hazards.

(c) Inclined travelways shall be constructed of nonskid material or equipped with cleats.

(d) Regularly used travelways shall be sanded, salted, or cleared of snow and ice as soon as practicable.

(e) Crossovers, elevated walkways, elevated ramps and stairways shall be of substantial construction, provided with handrails and maintained in good condition. Where necessary, toeboards shall be provided.

(f) Crossovers shall be provided where it is necessary to cross conveyors.

(g) Conveyors shall be crossed only at designated crossover points, except where repairs or maintenance is performed and the power is off and the conveyor is blocked against motion.

§ 77.206 Ladders and scaffolding; construction; installation; maintenance.

(a) *General requirements; ladders.* (1) Ladders shall be of substantial construction and maintained in good condition.

(2) Oil and grease shall not be allowed to accumulate on ladders.

(3) Ladders shall not be used in a horizontal position as platforms, runways, or scaffolds.

(4) Ladders shall be visually inspected before each use for broken rungs, split side rails, loose fastenings, decayed wood or other defects. Ladders with defects shall not be used.

(b) *Portable ladders; construction, use and maintenance.* (1) Portable ladders shall be so placed as to prevent slipping, or they shall be properly secured in position.

(2) On two section extension ladders, the minimum overlap for the two sections in use shall be as follows:

Size of ladder (feet):	*Overlap (feet)*
Up to and including 36	3
Over 36 and up to and including 48	4
Over 48 and up to and including 60	5

(3) No ladder shall be used to gain access to a roof or platform unless the top of the ladder extends at least 3 feet above the point of support, eave, gutter, roof line or platform.

(c) *Fixed ladders.* (1) Steep or vertical ladders (60° to 90° from the horizontal) shall be anchored securely and provided with:

(i) Backguards extending from a point not more than 7 feet from the bottom of the ladder to the top of the ladder, or

(ii) A ladder safety device meeting the requirements of American National Standards Institute (ANSI) A14.3–1974, "Safety Requirements for Fixed Ladders."

(2) Ladders shall extend at least 3 feet above the landing or substantial handholds shall be provided above the landing.

(3) Ladders shall not incline backwards at any point unless provided with backguards.

(4) Ladders shall be anchored securely and installed to provide at least 3 inches of toe clearance.

§ 77.206–1 Scaffolding; general.

(a) Scaffolds shall be erected in accordance with the requirements of this section.

(b) The footing or anchorage for scaffolds shall be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Unstable objects shall not be used to support scaffolds.

(c) No scaffold shall be erected, moved, dismantled or altered except under supervision of a person experienced in performing such work.

(d) Guardrails and toeboards shall be installed on all open sides and ends of platforms more than 10 feet above the ground or floor.

(e) Scaffolds and their components shall be capable of supporting at least four times the maximum intended load.

(f) Any scaffold, including accessories such as braces, brackets, trusses, screw lugs and ladders, damaged or weakened from any cause shall be immediately repaired or replaced.

(g) All planking or platforms shall be overlapped (minimum 12 inches) or secured from movement.

(h) Scaffold planks shall extend over their end supports not less than 6 inches and not more than 18 inches.

(i) The poles, legs or uprights of scaffolds shall be securely and rigidly braced and aligned to prevent swaying and displacement.

(j) Overhead protection shall be provided for men on a scaffold exposed to overhead hazards.

(k) Slippery conditions on scaffolds shall be eliminated prior to any other work being performed on or from such scaffolds.

(l) No welding, burning, riveting or open flame work shall be performed on or from any staging suspended by means of fiber or synthetic rope. Only treated or protected fiber or synthetic rope shall be used for or near any work involving the use of corrosive substances or chemicals.

(m) Wire, synthetic or fiber rope, used for scaffold suspension shall be capable of supporting six times the applied load.

(n) The use of shore or lean-to scaffolds is prohibited.

(o) Work shall not be performed on or from exposed scaffolds during storms or high winds that create a hazard.

§ 77.207 Illumination.

All areas where persons regularly work or travel shall be illuminated to not less than the average illumination intensities specified in this section. The illumination shall not exceed the uniformity ratio specified in this section.

(a) *Interiors of structures and facilities—illumination intensities while persons are present:*

Location	Average illumination intensity in foot-candles	Uniformity ratio
(1) Control rooms and control stations	10.0	5/1
(2) Electrical equipment rooms and power switch gear	10.0	5/1
(3) Shops	10.0	5/1
(4) Storerooms	2.0	5/1
(5) Walkways	5.0	5/1
(6) All other areas	5.0	5/1

(b) *Exterior work areas of structures and facilities—illumination intensities at all times unless otherwise noted:*

Location	Average illumination intensity in footcandles	Uniformity ratio
(1) Active building entrances and exits	2.0	5/1
(2) Shaft landing	2.0	5/1
(3) Storage areas while persons are present	2.0	10/1
(4) Coal loading and unloading while persons are present	2.0	5/1
(5) Conveyor walkways while persons are present:		
(i) Guarded conveyors	2.0	10/1
(ii) Unguarded conveyors	5.0	10/1
(6) Loading platforms while persons are present	2.0	10/1
(7) Paths and walkways within 200 ft of surface structures	1.0	10/1
(8) Refueling areas while persons are present	5.0	10/1
(9) Active tracks	1.0	10/1
(10) Active track switch points	2.0	10/1
(11) Parking lots	.5	10/1
(12) General work areas while persons are present	5.0	10/1

(c) *Slopes, tunnels and shafts—illumination intensities while persons are present:*

Location	Average illumination intensity in footcandles	Uniformity ratio
(1) Bottoms of slopes, tunnels, and shafts under construction and shafts under construction	5.0	5/1
(2) Walkways in slopes and tunnels	2.0	10/1
(3) All other areas in slopes and tunnels	2.0	10/1

(d) *Draglines, shovels and wheel excavators—illumination intensities while equipment is operated unless otherwise noted:*

Location	Average illumination intensity in footcandles	Uniformity ratio
(1) Interior walkways while persons are present	10.0	10/1
(2) All other interior areas, except operating cabs while persons are present	10.0	10/1
(3) All areas 20 ft in all directions from the main frame, including all work or travel areas beneath the main frame	5.0	10/1
(4) Exterior walkways on board draglines, shovels, and wheels excavators	5.0	10/1
(5) The area beneath the boom from 20 ft from the main frame to the farthest point the equipment is capable of excavating or discharging material	1.0	10/1

(e) *Other self-propelled equipment—illumination intensities while the equipment is operated:*

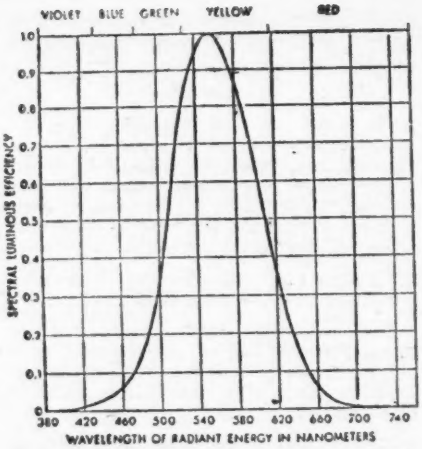
Location	Average illumination intensity in footcandles	Uniformity ratio
(1) Except as provided in par. (e)(2) an area to the front and to the rear of all rubber tired or crawler mounted scrapers, front-end loaders, dozers, graders, loaders, and tractors. The areas shall start at the point the operator can normally see the ground surface and extend for a distance of 20 ft and for a width equal to the machine width	1.0	10/1
(2) An area to the side of equipment where operating visibility is normally to the side. The area shall start at the side edge of the blade or bucket and extend to the side and rear of the blade or bucket for a distance of 5 ft	1.0	10/1
(3) All areas within 10 ft of the hole being drilled by vertical drills, except small pneumatic drills	5.0	10/1
(4) All areas within 10 ft of horizontal drills and coal augers. On board work areas of horizontal drills and coal augers	5.0	10/1

(f) Persons assigned, or allowed, or required to perform work or travel in locations not covered by paragraphs (a) through (e) of this section and the illumination is less than 0.5 footcandles shall be provided with and shall use a hand or cap lamp sufficient to provide adequate illumination for safe performance of assigned tasks.

§ 77.207–1 Light measuring instruments and methods of measurement.

(a) Compliance with § 77.207 shall be determined by MESA using light measuring instruments and methods of measurement prescribed by this section.

(b) Light measuring instruments shall be cosine-corrected and properly calibrated and maintained. Instruments shall be calibrated against standards traceable to the National Bureau of Standards and color-corrected to the Commission International de l'Eclairage (CIE) Spectral Luminous Curve. The CIE Spectral Luminous Curve is as follows:



(c) Except as provided in paragraph (d) and (e) of this section, the surfaces to be measured shall be divided into fields having an area not greater than 100 square feet. The surface of the light-sensitive cell shall be held in a horizontal plane approximately 30 inches from the surface to be measured. The average illumination intensity for that field shall be considered to be the average of five readings; one taken at each of the four corners of the field and one taken in the center of the field. When measuring the areas specified in § 77.207(e) the light-sensitive cell shall be angled for the maximum reading.

(d) The average illumination intensity for paths and walkways specified in §§ 77.207(a)(5), (b)(5), (b)(7), (c)(2), (d)(1) and (d)(4) shall be considered to be the average of at least four evenly spaced readings taken at intervals of 10 feet along the path or walkway. Where the length of the path or walkway is insufficient to allow four readings to be taken at 10-foot intervals, the average illumination intensity shall be considered to be the average of four evenly spaced readings taken along the path or walkway. The surface of the light-sensitive cell shall be held in a horizontal plane approximately 30 inches from the surface to be measured. Where the path or walkway is illuminated by evenly spaced luminaries installed above or along the path or walkway, the average of at least four evenly spaced readings taken at intervals of not more than 10 feet shall be sufficient to determine compliance for the entire path or walkway; provided the first reading is taken under one luminarie and the last reading is taken under the next adjacent luminarie.

(e) The average illumination intensity for areas beneath booms of draglines, shovels and wheel excavators, shall be

considered to be the average of the readings taken when the boom is positioned over level terrain. At least four evenly spaced readings shall be taken at intervals of not more than 10 feet along the center line of the boom from 20 feet from the main frame of the machine to the farthest point the machine is capable of excavating or discharging material. The light-sensitive cell shall be held in a horizontal plane and approximately 30 inches above ground.

(f) The uniformity ration (UR) shall be calculated as the average to minimum illumination intensity for paragraphs (c), (d) and (e) of this section. Two examples are shown below. Both examples have the required illumination in footcandles (fc); however, example (1) exceeds the uniformity ratio.

(1) *Control room*

$$UR=\frac{\text{Average illumination intensity}}{\text{Minimum illumination intensity}}=\frac{14.4fc}{2fc}=7.2/1$$

(2) *Belt walkway*

$$UR=\frac{\text{Average illumination intensity}}{\text{Minimum illumination intensity}}=\frac{6.0fc}{.7fc}=8.6/1$$

§ 77.208 Storage of materials; general.

(a) Materials shall be stored and stacked in a manner which minimizes stumbling or fall-of-material hazards.

(1) All materials stored in tiers shall lie stacked, racked, blocked, interlocked or secured by other means to prevent sliding, falling or collapse.

(2) Aisles and passageways shall be kept clear, clean and in good repair.

(3) Material stored inside buildings under construction shall not be stored within 6 feet of any hoistway or inside floor opening. Material shall not be stored within 10 feet of an exterior wall which does not extend above the top of material stored.

(b) Materials that can create hazards if accidentally liberated from their containers shall be stored in a manner to prevent the danger.

(c) Hazardous materials shall be stored in containers of a type approved for such use by recognized agencies; such containers shall be labeled appropriately.

§ 77.208–1 Transportation of liquefied and nonliquefied compressed gas cylinders.

(a) Liquefied and nonliquefied compressed gas cylinders while being transpored shall be:

(1) Placed securely in devices designed to hold the cylinder in place during transit;

(2) Disconnected from all hoses and gauges except when the cylinder is mounted as an integral part of mobile equipment, and the gauges and cylinder valve are protected by the design of mobile equipment from being knocked off or dislodged;

(3) Equipped with a metal cap or "headband" (fence-type metal protector around the valve stem) to protect the cylinder valve during transit except when the cylinder valve is protected as provided in paragraph (a)(2) of this section; and

(4) Shut off at cylinder valve.

(b) When liquefied and nonliquefied compressed gas cylinders are transported by a trolley wire haulage system, such cylinders shall be placed in well insulated and substantially constructed containers which are specifically designed for holding such cylinders.

(c) Liquefied and nonliquefied compressed gas cylinders shall not be transported on mantrips.

(d) Valve protection caps, where a cylinder is designed to accept a cap, shall be in place, hand-tight, except where cylinders are in use or connected for use.

§ 77.208–2 Storage of liquefied and nonliquefied compressed gas cylinders.

(a) In addition to the general storage requirements prescribed in § 77.208, liquefied and nonliquefied compressed gas cylinders in storage shall be:

(1) Clearly marked and identified as to their contents.

(2) Placed securely in storage areas designated by the operator for such purpose, in an upright position and secured against being accidentally tipped over.

(3) Protected against damage from falling material, contact with powerlines and energized electrical equipment, heat from welding, cutting, or soldering, and exposure to flammable liquids. Oxygen cylinders shall not be stored in an acetylene generator compartment.

§ 77.208–3 Use of liquefied and nonliquefied compressed gas cylinders.

(a) Persons assigned by the operator to use and work with liquefied and nonliquefied compressed gas shall be trained and designated by the operator to perform the work to which they are assigned, and such persons shall be specifically instructed with respect to the dangers in the use of such gases.

(b) Persons who perform welding, cutting or burning operations shall wear clothing free from excessive oil or grease.

(c) Liquefied and nonliquefied compressed gas cylinders shall be placed in an upright position and chained or otherwise secured against falling.

(d) Liquefied and nonliquefied compressed gas shall not be used under direct pressure from the cylinder and where such gases are used under reduced pressure, the pressure level shall not exceed that recommended by the manufacturer.

(e) "Manifolding of cylinders" shall only be performed in well ventilated areas where the necesary equipment is properly installed and operated in accordance with specifications for safety prescribed by the manufacturer.

(f) When in storage, the valves of all liquefied and nonliquefied compressed gas cylinder shall be in the closed position. Valve protection caps, where a cylinder is designed to accept a cap, shall be in place and hand-tight.

§ 77.208–4 Maintenance and tests of liquefied and nonliquefied compressed gas cylinders; accessories and equipment.

(a) Hose lines, gauges and other cylinder accessories shall be maintained in a safe operating condition.

(b) Defective cylinders, cylinder accessories, torches and other welding, cutting and burning equipment shall be labeled "Defective" and taken out of service.

(c) Liquefied and nonliquefied compressed gas cylinders, when in use, shall be equipped with a wrench specifically designed for use with liquefied and nonliquefied compressed gas cylinders and a suitable torchtip cleaner to maintain torches in a safe operating condition.

(d) Tests for leaks on the hose valves or gauges of liquefied and nonliquefied compressed gas cylinders shall only be made with a soft brush and soapy water or soap suds, or other device approved by the Secretary.

(e) Hose lines shall be provided with check valves at the gauge end to protect the gauges.

§ 77.208–5 Exemption of small low-pressure gas cylinders containing nonflammable or nonexplosive gas mixtures.

Small low-pressure gas cylinders containing nonflammable or nonexplosive gas mixtures, which provide for the emission of such gas under a pressure reduced from a pressure which does not exced 250 P.S.I.G., and which is manufactured and sold in conformance with U.S. Department of Transportation Special Permit No. 6029 as a calibration test kit for methane monitoring systems, shall be exempt from the requirements of §§ 77.208–1(c) and 77.208.3(c).

§ 77.209 Surge and storage piles.

No persons shall be permitted to walk or stand immediately above a reclaiming area or in any other area at or near a surge or storage pile where the reclaiming operation may expose him to a hazard.

§ 77.210 Hoisting of materials.

(a) Hitches and slings used to hoist materials shall be suitable for handling the type of materials being hoisted.

(b) A hoist shall not lift loads greater than the rated capacity of the hoist being used.

(c) Men shall stay clear of hoisted loads.

(d) Taglines shall be attached to hoisted materials that require steadying or guidance.

§ 77.210–1 Rigging equipment for material handling.

(a) *General requirements.* (1) Rigging equipment used for material handling shall be inspected immediately prior to each use, except excavation equipment where persons are not required to work under the load. Defective rigging equipment shall be removed from service.

(2) Rigging equipment shall not be loaded in excess of its safe working load.

(3) Special 'custom design grabs, hooks, clamps or other similar accessory rigging equipment used for lifting shall be marked to indicate the safe working loads.

(b) *Alloy steel chains.* (1) Hooks, rings, oblong links, pear-shaped links, welded or mechanical coupling links or other attachments, when used with alloy steel chains shall have a rated capacity at least equal to that of the chain.

(2) Shop made hooks, rings, links or other attachments, shall be properly designed and well constructed.

(3) Rated capacity (maximum working load limit) for alloy steel chain slings shall conform to the valves shown in Table C–1.

(4) Whenever wear at any point of any chain link exceeds that shown in Table C–2, the assembly shall be removed from service.

TABLE C–1.—*Rated capacity (maximum working load limit) for alloy steel chain slings—pounds*

Chain size, inches	Single branch sling—90° loading	Double sling vertical angle			Triple and quadruple sling vertical angle		
		30°	45°	60°	30°	45°	60°
		Horizontal angle			Horizontal angle		
		60°	45°	30°	60°	45°	30°
¼	2,250	5,560	4,550	3,250	8,400	6,800	4,900
⅜	6,600	11,400	9,300	6,600	17,000	14,000	9,900
½	11,250	19,500	15,900	11,250	29,000	24,000	17,000
⅝	16,500	28,500	23,300	16,500	43,000	35,000	24,500
¾	23,000	39,800	32,500	23,000	59,500	48,500	34,500
⅞	28,750	49,800	40,600	28,750	74,500	61,000	43,000
1	38,750	67,100	54,800	38,750	101,000	82,000	58,000
1¼	44,500	77,000	63,000	44,500	115,500	94,500	66,500
1¼	57,500	99,500	81,000	57,500	149,000	121,500	86,000
1⅜	67,000	116,000	94,000	67,000	174,000	141,000	100,500
1½	80,000	138,000	112,500	80,000	207,000	169,000	119,500
1¾	100,000	172,000	140,000	100,000	258,000	210,000	150,000

TABLE C–2.—*Maximum allowable wear at any point of link*

Chain size (inches)	Maximum allowable wear (inch)	Chain size (inches)	Maximum allowable wear (inch)	Chain size (inches)	Maximum allowable wear (inch)
¼	3/64	¾	5/32	1¼	¼
⅜	5/64	⅞	11/64	1⅜	9/32
½	7/64	1	3/16	1½	5/16
⅝	9/64	1⅛	7/32	1¾	11/32

(c) *Wire rope.* (1) Tables C–3 through C–6 shall be used to determine the safe working loads of various sizes and classifications of improved plow steel wire rope and wire rope slings. For sizes, classifications and grades not included in these tables, the safe working load recommended by the manufacturer for specific identifiable products shall be followed, if a factor of safety of not less than 5 is provided.

TABLE C–3.—*Rated capacities for single leg slings—6 by 19 and 6 by 37 classification improved plow steel grade rope with fiber core (FC)*

Rope diameter (inches)	Construction	Rated capacities, tons (2,000 lb)								
		Vertical			Choker			Vertical basket [1]		
		HT	MS	S	HT	MS	S	HT	MS	S
5/16	6 by 19	0.49	0.51	0.55	0.37	0.38	0.41	0.99	1.0	1.1
3/8	do	.76	.79	.85	.57	.59	.64	1.5	1.6	1.7
7/16	do	1.1	1.1	1.2	.80	.85	.91	2.1	2.2	2.4
1/2	do	1.4	1.5	1.6	1.1	1.1	1.2	1.9	3.0	3.3
9/16	do	1.8	2.0	2.1	1.4	1.5	1.6	3.7	3.9	4.3
5/8	do	2.3	2.5	2.7	1.7	1.9	2.0	4.6	5.0	5.4
11/16	do	2.8	3.1	3.3	2.1	2.3	2.5	5.6	6.2	6.7
3/4	do	3.9	4.4	4.8	2.9	3.3	3.6	7.8	8.8	9.5
7/8	do	5.1	5.9	6.4	3.9	4.5	4.8	10.0	12.0	13.0
1	do	6.7	7.7	8.4	5.0	5.8	6.3	13.0	15.0	17.0
1 1/8	do	8.4	9.5	10.0	6.3	7.1	7.9	17.0	19.0	21.0
1 1/4	6 by 37	9.8	11.0	12.0	7.4	8.3	9.2	20.0	22.0	25.0
1 3/8	do	12.0	13.0	15.0	8.9	10.0	11.0	24.0	27.0	30.0
1 1/2	do	14.0	16.0	17.0	10.0	12.0	13.0	28.0	32.0	35.0
1 5/8	do	16.0	18.0	21.0	12.0	14.0	15.0	33.0	37.0	41.0
1 3/4	do	19.0	21.0	24.0	14.0	16.0	18.0	38.0	43.0	48.0
2	do	25.0	28.0	31.0	18.0	21.0	23.0	49.0	55.0	62.0

[1] These values only apply when the D/d ratio for HT slings is 10 or greater, and for MS and S slings is 20 or greater where: D=diameter of curvature around which the body of the sling is bent; d=diameter of rope.

HT=hand tucked splice and hidden tuck splice. For hidden tuck splice (IWRC) use values in HT columns.
MS=mechanical splice.
S=swaged or zinc poured socket.

TABLE C–4.—*Rated capacities for single-leg slings—6 by 19 and 6 by 37 classification improved plow steel grade rope with independent wire rope core (IWRC)*

Rope Dia (inches)	Construction	Rated capacities, tons (2,000 lb) Vertical HT	Vertical MS	Vertical S	Choker HT	Choker MS	Choker S	Vertical Basket[1] HT	Vertical Basket[1] MS	Vertical Basket[1] S
1/4	6 by 19	0.53	0.56	0.59	0.40	0.42	0.44	1.0	1.1	1.2
5/16	do	.81	.87	.92	.61	.65	.69	1.6	1.7	1.8
3/8	do	1.1	1.2	1.3	.86	.93	.98	2.3	2.5	2.6
7/16	do	1.5	1.7	1.8	1.2	1.3	1.3	3.1	3.4	3.5
1/2	do	2.0	2.2	2.3	1.5	1.6	1.7	3.9	4.4	4.6
9/16	do	2.5	2.7	2.9	1.8	2.1	2.2	4.9	5.5	5.8
5/8	do	3.0	3.4	3.6	2.2	2.5	2.7	6.0	6.8	7.2
3/4	do	4.2	4.9	5.1	3.1	3.6	3.8	8.4	9.7	10.0
7/8	do	5.5	6.6	6.9	4.1	4.9	5.2	11.0	13.0	14.0
1	do	7.2	8.5	9.0	5.4	6.4	6.7	14.0	17.0	18.0
1 1/8	do	9.0	10.0	11.0	6.8	7.8	8.5	18.0	21.0	23.0
1 1/4	6 by 37	10.0	12.0	13.0	7.9	9.2	9.9	21.0	24.0	26.0
1 3/8	do	13.0	15.0	16.0	9.6	11.0	12.0	25.0	29.0	32.0
1 1/2	do	15.0	17.0	19.0	11.0	13.0	14.0	30.0	35.0	38.0
1 5/8	do	18.0	20.0	22.0	13.0	15.0	17.0	35.0	41.0	44.0
1 3/4	do	20.0	24.0	26.0	15.0	18.0	19.0	41.0	47.0	51.0
2	do	26.0	30.0	33.0	20.0	23.0	25.0	53.0	61.0	66.0

[1] These values only apply when the D/d ration for HT slings is 10 or greater, and for MS and S slings is 20 or greater where: D=diameter of curvature around which the body of the sling is bent; d=diameter of rope.

HT=Hand tucked splice. For hidden tuck splice (IWRC) use table H–3 values in HT column.
MS=Mechanical splice.
S=Swaged or zinc poured socket.

TABLE C–5.—*Rated capacities for 2-leg and 3-leg bridle slings—6 by 19 and 6 by 37 classification improved plow steel grade rope with fiber core (FC)*

Rope Dia (inches)	Construction	Rated capacities, tons (2,000 lb) 2-leg bridle slings: Vertical 30° Horizontal 60° HT	MS	45° angle HT	MS	Vertical 60° Horizontal 30° HT	MS	3-leg bridle slings: Vertical 30° Horizontal 60° HT	MS	45° angle HT	MS	Vertical 60° Horizontal 30° HT	MS
1/4	6 by 19	0.85	0.88	0.70	0.72	0.49	0.51	1.3	1.3	1.0	1.1	0.74	0.7
5/16	do	1.3	1.4	1.1	1.1	.76	.79	2.0	2.0	1.6	1.7	1.1	1.3
3/8	do	1.8	1.9	1.5	1.6	1.1	1.1	2.8	2.9	2.3	2.4	1.6	1.7
7/16	do	2.5	2.8	2.0	2.2	1.4	1.5	3.7	4.0	3.0	3.3	2.1	2.3
1/2	do	3.2	3.4	2.6	2.6	1.8	2.0	4.8	5.1	3.9	4.2	2.8	3.0
9/16	do	4.0	4.3	3.2	3.5	2.3	2.5	6.0	6.5	4.9	5.3	3.4	3.7
5/8	do	4.8	5.3	4.0	4.4	2.8	3.1	7.3	8.0	5.9	6.5	4.2	4.6
3/4	do	6.8	7.6	5.5	6.2	3.9	4.4	10.0	11.0	8.3	9.3	5.8	6.6
7/8	do	8.9	10.0	7.3	8.4	5.1	5.9	13.0	15.0	11.0	13.0	7.7	8.9
1	do	11.0	13.0	9.4	11.0	6.7	7.7	17.0	20.0	14.0	16.0	10.0	11.0
1 1/8	do	14.0	16.0	12.0	13.0	8.4	9.5	22.0	24.0	18.0	20.0	13.0	14.0
1 1/4	6 by 37	17.0	19.0	14.0	16.0	9.8	11.0	25.0	29.0	21.0	23.0	15.0	17.0
1 3/8	do	20.0	23.0	17.0	19.0	12.0	13.0	31.0	35.0	26.0	28.0	18.0	20.0
1 1/2	do	24.0	27.0	20.0	22.0	14.0	16.0	36.0	41.0	30.0	33.0	21.0	24.0
1 5/8	do	28.0	32.0	23.0	26.0	16.0	18.0	43.0	48.0	35.0	39.0	25.0	28.0
1 3/4	do	33.0	37.0	27.0	30.0	19.0	21.0	49.0	55.0	40.0	45.0	28.0	32.0
2	do	43.0	48.0	35.0	39.0	25.0	28.0	64.0	72.0	52.0	59.0	37.0	41.0

HT=Hand tucked splice.
MS=Mechanical splice.

TABLE C–6.—*Rated capacities for 2-leg and 3-leg bridle slings—6 by 19 and 6 by 37 classification improved plow steel grade rope with independent wire rope core (IWRC)*

Rope Dia (inches)	Constr	Rated capacities, tons (2,000 lb) 2-leg bridle sling: Vertical 30° Horizontal 60° HT	MS	45° angle HT	MS	Vertical 60° Horizontal 30° HT	MS	3-leg bridle sling: Vertical 30° Horizontal 60° HT	MS	45° angle HT	MS	Vertical 60° Horizontal 30° HT	MS
1/4	6 by 19	0.92	0.97	0.75	0.79	0.53	0.56	1.4	1.4	1.1	1.2	0.79	0.8[1]
5/16	do	1.4	1.5	1.1	1.2	1.81	.87	2.1	2.3	1.7	1.8	1.2	1.3
3/8	do	2.0	2.1	1.6	1.8	1.1	1.2	3.0	3.2	2.4	2.6	1.7	1.9
7/16	do	2.7	2.9	2.2	2.4	1.5	1.7	4.0	4.4	3.3	3.6	2.3	2.5
1/2	do	3.4	3.8	2.8	3.1	2.0	2.2	5.1	5.7	4.2	4.6	3.0	3.3
9/16	do	4.3	4.8	3.5	3.9	2.5	2.7	6.4	7.1	5.2	5.8	3.7	4.1
5/8	do	5.2	5.9	4.2	4.8	3.0	3.4	7.8	8.8	6.4	7.2	4.5	5.1
3/4	do	7.3	8.4	5.9	6.9	4.2	4.9	11.0	13.0	8.9	10.0	6.3	7.3
7/8	do	9.6	11.0	7.8	9.2	5.5	6.6	14.0	17.0	12.0	14.0	8.3	9.9
1	do	12.0	15.0	10.0	12.0	7.2	8.5	19.0	22.0	15.0	18.0	11.0	13.0
1 1/8	do	16.0	18.0	13.0	15.0	9.0	10.0	23.0	27.0	19.0	22.0	13.0	16.0
1 1/4	6 by 37	18.0	21.0	15.0	17.0	10.0	12.0	27.0	32.0	23.0	26.0	16.0	18.0
1 3/8	do	22.0	25.0	18.0	21.0	13.0	15.0	33.0	38.0	27.0	31.0	19.0	22.0
1 1/2	do	26.0	30.0	21.0	25.0	15.0	17.0	39.0	45.0	33.0	37.0	23.0	26.0
1 5/8	do	31.0	35.0	25.0	29.0	18.0	20.0	46.0	53.0	38.0	43.0	27.0	31.0
1 3/4	do	35.0	41.0	29.0	33.0	20.0	24.0	53.0	61.0	43.0	50.0	31.0	35.0
2	do	46.0	53.0	37.0	43.0	26.0	30.0	68.0	79.0	56.0	65.0	40.0	46.0

(2) Protruding ends of strands in splices on slings and bridles shall be covered or blunted.

(3) Wire rope shall not be secured by knots.

(4) When U-bolt wire clips are used to form eyes, Table C–7 shall be used to determine the number and spacing of clips.

TABLE C–7.—*Number and spacing of U-bolt wire rope clips*

Improved plow steel, rope diameter inches	Number of clips: Drop forged	Other material	Minimum spacing (inches)
1/4	3	3	3
5/16	3	4	3 1/2
3/8	4	4	4 1/2
7/16	4	5	5 1/4
1/2	5	5	6
9/16	6	6	6 3/4
5/8	6	7	7 1/2
3/4	7	7	8 1/4
7/8	7	8	9

(d) *Natural and synthetic fiber rope.* (1) All splices in rope slings shall be made in accordance with the rope manufacturer's recommendations and in accordance with the following:

(i) In Manila rope, eye splices shall contain at least three full tucks and short splices shall contain at least six full tucks (three on each side of the centerline of the splice).

(ii) In layed synthetic fiber rope, eye splices shall contain at least four full tucks and short splices shall contain at least eight full tucks (four on each side of the centerline of the splice).

(iii) Strand-end tails shall not be trimmed short (flush with the rope surface) immediately adjacent to the full tucks. This precaution applies to both eye and short splices and all types of fiber rope. For fiber ropes under 1-inch diameter, the tails shall project at least six rope diameters beyond the last full tuck. For fiber ropes 1-inch diameter and larger, the tails shall project at least six inches beyond the last full tuck. Where the projecting tails create a hazard, the tails shall be tapered and spliced into the body of the rope using at least two additional tucks (which will require a tail length of approximately six rope diameters beyond the last full tuck).

(iv) For all eye splices, the eye shall be sufficiently large to provide an included angle of not greater than 60 degrees at the splice when the eye is placed over the load or support.

(2) Knots shall not be used in lieu of splices.

(e) *Synthetic webbing (nylon, polyester, and polypropylene).* (1) Each synthetic web sling shall be marked or coded to show:

(i) Name or trademark of manufacturer.

(ii) Rated capacities for the type of hitch.

(iii) Type of material.

(2) Rated capacity shall not be exceeded.

(f) *Shackles and hooks.* (1) Table C–8 shall be used to determine the safe working loads of various sizes of shack-

les, except that higher safe working loads are acceptable when recommended by the manufacturer for specific identifiable products if a safety factor of not less than 5 is provided.

TABLE C–8.—*Safe working loads for shackles*

[In tons of 2,000 lb]

Material size (inches)	Pin diameter (inches)	Safe working load
½	⅝	1.4
⅝	⅞	2.2
¾	1	3.2
⅞	1⅛	4.3
1	1¼	5.6
1⅛	1⅜	6.7
1¼	1½	8.2
1⅜	1⅝	10.0
1½	1¾	11.9
1⅝	2	16.2
2	2¼	21.2

(2) The manufacturer's recommendations shall be followed in determining the safe working loads of the various sizes and types of specified and identifiable hooks. All hooks for which no applicable manufacturer's recommendations are available shall be tested to twice the intended safe working load before they are initially put into use. A record of the dates and results of such tests shall be kept at the mine.

§ 77.211 Draw-off tunnels; stockpiling and reclaiming operations; general.

(a) Tunnels located below stockpiles, surge piles and coal storage silos shall be ventilated so as to maintain concentrations of methane below 1.0 volume per centum.

(b) In addition to the tests for methane required by § 47.201–1, such tests shall also be made before any electric equipment is energized or repaired, unless equipped with a continuous methane monitoring device installed and operated in accordance with the provisions of § 77.211–1. Electric equipment shall not be energized, operated or repaired until the air contains less than 1.0 volume per centum of methane.

§ 77.211–1 Continuous methane monitoring device; installation and operation; automatic deenergization of electric equipment.

Continuous methane monitoring devices shall be set to deenergize, automatically, electric equipment when such monitor is not operating properly and to give a warning automatically when the concentration of methane reaches a maximum percentage determined by an authorized representative of the Secretary which shall not be more than 1.0 volume per centum of methane. An authorized representative of the Secretary shall require such monitor to deenergize, automatically, electric equipment when the concentration of methane reaches a maximum percentage determined by such representative which shall not be more than 2.0 volume per centum of methane.

§ 77.212 Draw-off tunnel ventilation fans; installation.

When fans are used to ventilate draw-off tunnels, the fans shall be:

(a) Installed on the surface;

(b) Installed in noncombustible housings and connected to the tunnel opening with noncombustible air ducts; and

(c) Offset from the tunnel opening.

§ 77.213 Draw-off tunnel escapeways.

When it is necessary for a tunnel to be closed at one end, an escapeway not less than 30 inches in diameter (or the equivalent, if the escapeway does not have a circular cross section) shall be installed which extends from the closed end of the tunnel to a safe location on the surface; and, if the escapeway is inclined more than 30 degrees from the horizontal, it shall be equipped with a ladder which runs the full length of the inclined portion of the escapeway.

4. A new § 77.218 is added as follows:

§ 77.218 Incorporation by reference.

In accordance with 5 U.S.C. 552(a)(1), the American National Standards Institute publication to which reference is made in this subpart is hereby incorporated by reference and made a part hereof. The incorporated publication is available for examination at each Coal Mine Health and Safety District and Subdistrict Office of MESA. It is also available from the American National Standards, Inc., 1430 Broadway, New York, N.Y. 10018. Incorporation by reference provisions approved by the Director of the Federal Register on (date to be inserted prior to final rulemaking).

5. Subpart D is revised as follows:

Subpart D—Thermal Dryers

§ 77.300 Thermal dryers; general.

(a) Dryer systems used for drying coal at high temperatures, hereinafter referred to as thermal dryers, including rotary dryers, continuous carrier dryers, vertical tray and cascade dryers, multilouver dryers, suspension or flash dryers and fluidized bed dryers, shall be maintained and operated in accordance with the provisions of §§ 77.300 through 77.306.

(b) For purposes of this subpart, "high temperature" means 212 degrees Fahrenheit or above.

§ 77.301 Dryer heating units; operation.

(a) Dryer heating units shall be operated to provide reasonably complete combustion before gases are allowed to enter hot gas inlets.

(b) Dryer heating units which are fired by pulverized coal shall be operated and maintained in accordance with National Fire Protection Association (NFPA) Code No. 60, "Standard for the Installation and Operation of Pulverized Fuel Systems" (1961).

§ 77.302 Bypass stacks.

(a) Thermal dryers systems shall include a bypass stack, relief stack or individual discharge stack provided with automatic venting which will permit gases from the dryer heating unit to bypass the heating chamber and vent to the outside atmosphere during any shutdown operation.

(b) Thermal dryer bypass stacks shall be equipped with a clean-out door at or near the bottom or with other effective means which permits coal, fly-ash, and other heated material to be removed.

§ 77.303 Dryer chamber drop-out doors.

(a) Thermal dryer systems which employ a hot gas inlet chamber shall be equipped with drop-out doors at the bottom of the inlet chamber or with other effective means which permits coal, fly-ash, or other heater material to fall from the chamber.

(b) Dryers which are fired by pulverized coal and positive pressure dryers which are not equipped with a constant drop-out door shall be checked once a week, and cleaned when necessary.

(c) Dryers which are fired by coal other than pulverized coal which are not equipped with a constant drop-out door shall be checked daily and cleaned when necessary.

§ 77.304 Explosion release vents.

(a) Drying chambers, dry-dust collectors, ductwork connecting dryers to dust collectors, and ductwork between dust collectors and discharge stacks shall be protected:

(1) With explosion release vents which open directly to the outside atmosphere, and all such vents shall be:

(i) Hinged to prevent dislodgment.

(ii) Designed and constructed to permit checking and testing by manual operation,

(iii) Checked by manual operation at intervals not exceeding 90 days. A record shall be kept of the date of the manual operation for at least one year, and

(iv) Equal in size to the cross-sectional area of the collector vortex finder when used to vent dry-dust collectors; or

(2) With a no less effective system approved by the District Manager.

§ 77.305 Access to drying chambers, hot gas inlet chambers and ductwork; installation and maintenance.

(a) Drying chambers, hot gas inlet chambers, and all ductwork in which coal dust may accumulate shall be equipped with tight sealing access doors which shall remain latched during dryer operations to prevent the emission of coal dust and the loss of fluidizing air.

(b) Cyclones and all ductwork shall be maintained in good repair.

§ 77.306 Fire protection.

(a) Based on the need for fire protection measures in connection with the particular design of the thermal dryers, the District Manager of the District in which the thermal dryer is located may require any of the following measures to be employed:

(1) Water sprays automatically actuated by a rise in temperature to prevent fire, installed inside the thermal dryer systems, and such sprays shall be designed to provide for manual operation in the event of power failure.

(2) Fog nozzles, or other no less effective means, installed inside the thermal dryer systems to provide ad-

ditional moisture or an artificial drying load within the drying system when the system is being started or shut down.

(b) The water system of each thermal dryer shall be inter-connected to a supply of compressed air which permits constant or frequent purging of all water sprays and fog nozzles or other no less effective means of purging shall be provided.

§ 77.307 Thermal dryers; location and installation; general.

(a) Thermal dryer systems erected or installed at any coal mine after June 30, 1971, except those thermal dryer systems referred to in paragraph (c) of this section, shall be located at least 100 feet from any underground coal mine opening, and 100 feet from any surface installation where the heat, sparks, flames, or coal dust from the system might cause a fire or explosion.

(b) Thermal dryer systems erected or installed after June 30, 1971, may be covered by roofs; however, such systems shall not be otherwise enclosed unless necessary to protect the health and safety of persons employed at the mine. Where such systems are enclosed, they shall be located in separate fireproof structures of heavy construction with explosion pressure release devices (such as hinged wall panels, window sashes, or louvers), which provide at least 1 square foot of area for each 80 cubic feet of space volume and which are distributed as uniformly as possible throughout the structure.

(c) Thermal dryer systems erected or installed after June 30, 1971 but [before the effective date of this section] in any structure which also houses a tipple, cleaning plant, or other operating facilities shall be separated from all other working areas of spuch structure by a substantial partition capable of providing greater resistance to explosion pressures than the exterior wall or walls of the structure. The partition shall also include substantial, self-closing fire doors at all entrances to the areas adjoining the dryer system.

(d) Thermal dryer systems erected or installed [after the effective date of this section] shall not be erected or installed in any structure which also houses a tipple, cleaning plant, or other operating facilities.

§ 77.308 Visual check of system equipment.

Frequent visual checks shall be made by the operator of th ethermal dryer system control station, or by some other person experienced in performing such work, of the bypass dampers, air-tempering louvers, discharge mechanism, and other dryer system equipment, and no dryer shall beb operated with defective equipment which would affect the safe operation of the thermal dryer.

§ 77.308–1 Control stations; location.

Thermal dryer system control stations constructed after June 30, 1971, shall be installed at a location which will give to the operator of the control station the widest field of visibility of the system and equipment.

§ 77.309 Control panels.

(a) All thermal dryer system control panels constructed after June 30, 1971, shall be located in an area which is relatively free of moisture and dust and shall be installed in such a manner as to minimize vibration.

(b) A schematic diagram containing legends which show the location of each thermocouple, pressure tap, or other control or gaging instrument in the drying system shall be posted on or near the control panel of each thermal drying system.

(c) Each instrument on the control panel shall be identified by a name-plate or equivalent marking.

(d) The manufacturer's safe drying inlet temperatures of the dryer shall be posted on or near the control panel of each thermal drying system.

(e) A plan to control the operation of each thermal dryer system shall be posted on or near the control panel showing a sequence of startup, normal shutdown, and emergency shutdown procedures.

§ 77.310 Alarm devices.

Thermal dryer systems shall be equipped with both audible and visual alarm devices set to operate when safe dryer temperatures are exceeded.

§ 77.311 Fail safe monitoring systems.

Thermal dryer systems and controls shall be protected by a fail safe monitoring system which will safely shut down the system and any related equipment upon failure of any component in the dryer system.

§ 77.312 Wet-coal feedbins; low-level indicators.

Wet-coal bins feeding thermal dryer systems shall be equipped with both audible and visual low-coal level indicators.

§ 77.313 Automatic temperature control instruments.

(a) Thermal dryer systems shall be equipped with automatic temperature control instruments.

(b) Automatic temperature control instruments for thermal dryer systems shall be of the recording type. The recording charts shall be kept for 3 months.

(c) Automatic temperature control instruments shall be locked or sealed to prevent tampering or unauthorized adjustment. These instruments shall not be set above the maximum allowable operating temperatures.

(d) All dryer control instruments shall be inspected and calibrated at least once every 3 months and a record or certificate of accuracy, signed by a trained person or by a servicing agent, shall be kept at the plant.

§ 77.314 Thermal dryers; examination and inspection.

(a) Thermal dryer systems shall be examined for fires and coal dust accumulations if the dryers are not restarted within the time period prescribed by the manufacturer after a shutdown.

(b) Before any person is permitted to enter a drying chamber which contains coal, the coal on the bedplate or screen shall be saturated with water.

§ 77.315 Incorporation by reference.

In accordance with 5 U.S.C. 552(a)(1), the National Fire Protection Association publication to which reference is made in this subpart is hereby incorporated by reference and made a part hereof. The incorporated publication is available for examination at each Coal Mine Health and Safety District and Subdistrict Office of MESA. It is also available from the National Fire Protection Association, 470 Atlantic Ave., Boston, Mass. 02210. Incorporation by reference provisions approved by the Director of the Federal Register on (date to be inserted prior to final rulemaking).

6. Sections 77.400 through 77.402 are revised and a new § 77.402–1 is added as follows:

Subpart E—Safeguards for Mechanical Equipment

§ 77.400 Mechanical equipment guards.

(a) Gears; sprockets; chains; conveyor-drive, head, tail and takeup pulleys; flywheels; couplings; shafts; sawblades; fan inlets; and similar exposed moving machine parts which may be contacted by persons, and which may cause injury to persons shall be guarded.

(b) Overhead belts shall be guarded if the whipping action from a broken belt would be hazardous to persons below.

(c) Guards at the conveyor-drive, head, tail and takeup pulleys shall extend a distance sufficient to prevent a person from reaching behind the guard and becoming caught between the belt and the pulley.

(d) Except when testing the machinery, guards shall be securely in place while machinery is being operated.

§ 77.401 Stationary grinding machines; protective devices.

(a) Stationary grinding machines other than special bit grinders shall be equipped with:

(1) Peripheral hoods (less than 90° throat openings) capable of withstanding the force of a bursting wheel.

(2) Adjustable tool rests set as close as practical to the wheel.

(3) Safety washers.

(b) Grinding wheels shall be operated within the specifications of the manufacturer of the wheel.

(c) Face shields or goggles, in good condition, shall be worn when operating a grinding wheel.

(d) Cutting bit grinding machines shall be equipped with dust collectors or exhaust ventilation systems vented to the outside of the building.

§ 77.402 Hand-held power tools; safety devices.

Hand-held power tools shall be equipped with controls requiring constant hand or finger pressure to operate the tools or shall be equipped with friction or other equivalent safety devices.

§ 77.402–1 Power operated hand-held tools.

(a) *Electric power hand-held tools.* (1) Electric cords shall not be used for hoisting, lowering, or carrying of hand-held tools.

(b) *Pneumatic power hand-held tools.* (1) Safety clips or retainers shall be securely installed on pneumatic impact tools to prevent attachments from being accidentally ejected.

(2) All pneumatically driven nailers, staplers, and other similar equipment provided with an automatic fastener feed and which operate at more than 100 p.s.i., at the tool, shall have a safety device on the muzzle to prevent the tool from ejecting fasteners unless the muzzle is in contact with the work surface.

(3) Hoses shall not be used for hoisting, lowering, or carrying of such tools.

(c) *Fuel-powered hand-held tools.* (1) All fuel-powered tools shall be stopped while being refueled, serviced, or maintained.

(d) *Powder-actuated hand-held tools.* (1) Only persons who have been instructed in the limitations and safe operation of the particular tool being used shall be permitted to operate a powder-actuated tool.

(2) The tool shall be tested each day before loading to see that the safety devices are in safe working condition. The method of testing shall be in accordance with the manufacturer's recommended procedure.

(3) Tools shall not be loaded until immediately prior to the intended firing time. Neither loaded nor empty tools shall be pointed at any person.

(4) Loaded tools shall not be left unattended.

(5) Fasteners shall be used in accordance with the manufacturer's recommendations.

(6) Driving into material easily penetrated shall be avoided unless such materials are backed by a substance that will prevent the fastening device from passing completely through and creating a flying missile hazard on the other side.

(7) Powder-actuated tools shall not be used in hazardous locations as set forth in §§ 77.516–1 and 77.516–3.

(8) All tools shall be used with the appropriate shield, guard, or attachment recommended by the manufacturer.

(9) Persons operating powder-actuated tools shall keep all parts of their bodies behind the tool.

7. Sections 77.404 through 77.413 are revised and new §§ 77.414 and 77.415 are added as follows:

§ 77.404 Portable, self-propelled and stationary machinery and equipment; operation and maintenance.

(a) Machinery and equipment shall be maintained in safe operating condition and machinery or equipment in unsafe condition shall be removed from service immediately.

(b) Machinery and equipment shall be operated only by persons trained in the use of and authorized to operate such machinery and equipment.

(c) Repairs or maintenance shall not be performed on machinery and equipment until the power is off and the machinery and equipment is blocked against motion, except where motion is necessary to make adjustments.

(d) Machinery and equipment shall not be lubricated while in motion where a hazard exists, unless equipped with extended fittings or cups.

§ 77.405 Performing work from a raised position; safeguards.

(a) Persons shall not work on or from a piece of mobile equipment in a raised position until it has been blocked in place securely. This does not preclude the use of equipment specifically designed as elevated mobile work platforms.

(b) No work shall be performed under machinery or equipment that has been raised until such machinery or equipment has been securely blocked in position.

§ 77.406 Drive belts.

(a) Drive belts shall not be shifted while in motion unles the machines are provided with mechanical shifters.

(b) Belt dressing shall not be applied while belts are in motion except where it can be applied without endangering a person.

§ 77.407 Power-driven pulleys.

(a) Belts, chains, and ropes shall not be guided onto power-driven moving pulleys, sprockets, or drums with the hands except slow moving equipment especially designed for hand feeding.

(b) Pulleys and rollers of conveyors shall not be cleaned manually while the conveyor is in motion.

(c) Coal or other material spilled beneath belt conveyor-drives, heads, tails or take-ups shall not be removed while the conveyor is in motion, unless 8 feet of clearance is maintained between the floor and conveyor-drive, head, tail or takeup.

§ 77.408 Welding operations.

(a) Welding operations shall be shielded and the area shall be well-ventilated.

(b) Defective electrode holders, cables, helmets or shields shall not be used.

(c) Electrodes shall not be changed in confined areas where restricted movement of the hands and arms would cause a shock hazard while the welding cable is energized.

§ 77.409 Shovels, draglines and tractors.

(a) Shovels, draglines, and tractors shall not be operated in the presence of any person exposed to a hazard from its operation, and all such equipment shall be provided with an adequate warning device which shall be sounded by the operator prior to starting operation.

(b) Shovels and draglines shall be equipped with handrails along and around all walkways and platforms.

§ 77.410 Self-propelled equipment; automatic warning devices and braking systems.

(a) Self-propelled equipment, such as trucks with an obstructed view to the rear, forklifts, front-end loaders, tractors, dozers and graders, shall be equipped with an adequate automatic warning device that shall give an audible alarm before such equipment is moved in the reverse direction and remain in operation until the equipment is at a complete stop or is placed in neutral or forward direction.

(b) Barrels, machine parts or supplies transported in front-end loader buckets shall be secured or properly loaded to prevent shifting, slipping or spillage.

(c) Rubber tired front-end loaders and dozers purchased after the effective date of this section shall be equipped with parking and emergency stopping systems which shall comply with the "Minimum Performance Criteria for Brake Systems for Off-Highway, Rubber-Tired Front-End Loaders and Dozers-SAE J 237" of the Society of Automotive Engineers.

§ 77.410–1 Tires and rim repair.

(a) A safety tire rack, cage, or equivalent protection shall be provided when inflating tires installed on split rims or rims equipped with locking rings or similar devices.

(b) Heat shall not be applied to lugbolts, rims or wheels while the tires are inflated.

(c) Before rims are repaired, tires shall be deflated and removed from the rims.

§ 77.411 Compressed air and boilers: general. —

All boilers and pressure vessels shall be constructed, installed, and maintained in accordance with the standards and specifications of the American Society of Mechanical Engineers' Boiler and Pressure Vessel Code.

§ 77.412 Compressed air systems.

(a) Compressors and compressed air receivers shall be equipped with automatic pressure-relief valves, pressure gauges, and drain valves.

(b) Repairs involving the pressure system of compressors, receivers, or compressed-air-powered equipment shall not be attempted until the pressure has been relieved from that part of the system to be repaired.

(c) At no time shall compressed air be directed toward a person. When compressed air is used, all necessary precautions shall be taken to protect persons from injury. Compressed air shall not be used for cleaning purposes unless a face shield or goggles which meet the requirements of § 77.1710(a) is used.

(d) Safety chains, suitable locking devices or automatic cutoff valves shall be used at connections to machines of high-pressure hose lines of ¾ inch outside diameter or larger, and between high-pressure hose lines of ¾ inch inside diameter or larger, where a connection failure

would create a hazard. For purposes of this paragraph, high-pressure means pressure of 100 p.s.i. or more.

§ 77.413 Boilers.

(a) Boilers shall be equipped with guarded, well-maintained water gauges and pressure gauges placed so that they can be observed easily. Water gauges and pipe passages to the gauges shall be kept clean and free of scale and rust.

(b) Boilers shall be equipped with automatic pressure-relief valves; valves shall be opened manually at least once a week to determine that they will function properly.

(c) Blowoff valves shall be piped outside the building or directly into drains and shall have outlets so located or protected that persons passing by, near, or under them will not be scalded.

(d) Where needed, boilers shall be provided with safety devices acceptable to MESA, to protect against hazards of flame-outs, fuel interruptions, and low water level.

(e) Boilers shall be inspected internally at least once a year by a representative of the manufacturer of such boiler or a state licensed inspector and a certificate of inspection, signed by the inspector, shall be displayed in the vicinity of the boiler.

§ 77.414 Marine operation and equipment.

(a) Unless persons can step safely to or from the wharf, float, barge, or river towboat, a safe walkway shall be provided.

(b) Decks or other working surfaces shall be maintained in a safe condition.

(c) Persons shall not pass fore or aft, over, or around deck-loads, unless a safe passage is provided.

(d) At least one U.S. Coast Guard approved 30 inch lifering with not less than 90 feet of line attached, and at least one portable or permanent ladder which will reach from the top of the apron to the surface of the water shall be provided in the vicinity of the barge.

§ 77.415 Incorporation by reference.

In accordance with 5 U.S.C. 552(a)(1), the publications to which references are made in this subpart are hereby incorporated by reference and made a part hereof. The incorporated publications are available for examination at each Coal Mine Health and Safety District and Subdistrict Office of MESA. SAE documents are also available from the Society of Automative Engineers, Inc., Two Pennsylvania Plaza, New York, N.Y. 10001. The ASME Boiler and Pressure Vessel Code is also available from the American Society of Mechanical Engineers, 345 E. 47th St., New York, N.Y. 10017. Incorporation by reference provisions approved by the Director of the Federal Register on (date to be inserted prior to final rulemaking).

8. Subparts F, G, H, I, J, and K are revised as follows:

Subpart F—Electrical Circuits and Equipment—General

§ 77.500 Electric power circuits and electric equipment; deenergization.

(a) Circuits which supply power to stationary and portable electric equipment, and circuits which supply power to electric equipment on board self-propelled equipment shall be deenergized before electrical or mechanical work is done on such circuits or equipment, except for testing or trouble-shooting as provided in this section and for repair of energized trolly wires as provided in § 77.1803. Other electric circuits or electric equipment in the vicinity of electrical or mechanical work shall also be deenergized if the location of such circuits or equipment creates a hazard to persons performing such work.

(b) Disconnecting devices used to deenergize such circuits and equipment shall be locked out and suitably tagged by the persons who perform such work, except that in cases where locking out is not possible, such devices shall be opened and suitably tagged by such persons. Locks and tags shall be removed only by the persons who installed them or, if such persons are not available, by persons authorized by the operator or his agent.

(c) Persons performing testing or trouble-shooting functions on circuits or equipment energized at more than 150 volts, but less than 1000 volts, shall wear protective gloves. Such gloves shall meet American Society for Testing and Materials (ASTM "Standard Specification for Rubber Insulating Gloves" (D120–70) and shall be rated in accordance with the following:

Nominal circuit voltage:	*ASTM glove class*
151 to 750 v	0
751 to 1,000 v	1

(d) Persons performing testing or trouble-shooting functions on circuits or equipment energized at more than 1,000 volts shall comply with the requirements of §§ 77.806 through 77.806–9.

(e) Protective gloves worn while performing testing or trouble-shooting functions shall be inspected for defects before each use. Defective gloves shall not be used.

§ 77.501 Electric circuits and equipment; maintenance.

(a) Electric circuits and equipment shall be maintained at all times in safe operating condition.

(b) Except as provided in § 77.1803, electrical installation and maintenance work shall not be performed on electric circuits or equipment except by a qualified person or by a person trained to perform electrical work and to maintain electric circuits and equipment at the direction of a qualified person. When such work is done by a trained person, the circuits or equipment shall be examined and tested by a qualified person to assure safe operating condition before such circuits or equipment are energized.

§ 77.502 Electric circuits and equipment; examination and testing.

Electric circuits and equipment shall be examined and tested at least monthly by a qualified person to assure safe operating conditions. When a potentially dangerous condition is found on electric circuits or equipment, by the qualified person making the required examination, such circuits or equipment shall be removed from service until such condition is corrected. A record of such examinations shall be kept in a book provided for this purpose and shall include the date of examination, all dangerous conditions found, corrective action taken, and the name of the examiner. The record of examination shall be signed by the official responsible for maintaining the circuits and equipment in safe operating condition and such records shall be made available to an authorized representative of the Secretary and an authorized representative of the miners of such mine.

§ 77.502–1 Electric circuits and equipment; potentially dangerous condition.

A potentially dangerous condition as used in § 77.502 shall include, but not be limited to, damaged conductor insulation, improper frame grounding, missing guards, missing inspection covers, poorly-made splices, inoperative ground fault protection and defective monitoring circuits.

§ 77.502–2 Electric powered hand-held tools.

Electric powered hand-held tools shall be considered electric equipment for the purposes of this subpart.

§ 77.503 Power conductors; capacity and insulation.

Power conductors shall be sufficient in size and have adequate current-carrying capacity and be of such construction that arise in temperature resulting from normal operation will not damage the conductor or the insulating materials.

§ 77.503–1 Power conductors; ampacity requirements.

(a) The required ampacities of all power conductors, except power conductors installed in high-voltage distribution circuits and power conductors installed in circuits referred to in § 77.606, shall be as specified in the National Electrical Code as follows:

(1) For conductors installed prior to June 30, 1971—the National Electrical Code, 1968, 1971, or 1975.

(2) For conductors installed after June 30, 1971, but before [the effective date of this section]—the National Electrical Code, 1971, or 1975.

(3) For conductors installed after [the effective date of this section]—the National Electrical Code, 1975.

(b) The required ampacities of power conductors installed in high-voltage distribution circuits are not specified.

(c) The required ampacities of power conductors installed in circuits referred to in § 77.606 shall be as specified in § 77.606.

§ 77.503–2 Power conductors; ampacity ratings.

(a) The ampacity rating of all power conductors, except uninsulated overhead power lines, trailing cables and portable feeder cables, shall be as specified in the National Electrical Code, 1975, as follows:

(1) Conductors for General Wiring—Article 310

(2) Flexible Cords and Cables—Article 400

(3) Fixture Wires—Article 402

(b) The ampacity rating of uninsulated overhead powerlines shall be as specified in the standards of the Insulated Power Cable Engineers Association (IPCEA) as follows:

Conductor material	IPCEA standard	Table
Single-layer ACSR	P-50-431	III
Multilayer ACSR	P-50-431	IV
Bare all aluminum	P-50-431	V
Weather-resistant all aluminum	P-50-431	IX
Weather-resistant ACSR	P-50-431	X
Copper	P-51-432	XIII
Weather-resistant hard drawn copper.	P-51-432	XIV

(c) The ampacity rating of trailing cables and portable feeder cables shall be as specified in § 77.606–1(a).

§ 77.504 Electrical connections, splices and insulation.

(a) Connections and splices in conductors shall be mechanically strong and electrically efficient, and suitable connectors shall be used.

(b) Splices in multi-conductor cables shall provide continuity of each conductor.

(c) Splices in insulated conductors shall be reinsulated so as to provide at least the same insulation value as the insulation on the remainder of the conductor and shall be sealed so as to exclude moisture.

(d) Splices in shielded conductors shall be reshielded so as to provide at least the same degree of protection as the shielding on the remainder of the conductor.

(e) Splices in jacketed conductors and cables shall be vulcanized or otherwise made with suitable materials to provide good bonding to the existing conductor jacket, to exclude moisture from the completed splice, and to provide at least the same degree of protection as the remainder of the conductor jacket.

§ 77.504–1 Repair of damaged conductors.

Damaged conductor insulation or jackets shall be repaired in a workmanlike manner so as to exclude moisture and to provide at least the same degree of protection as provided by the remainder of the conductor insulation or jacket.

§ 77.505 Cable fittings; suitability.

Cables and insulated conductors other than wiring installed in conduit shall enter metal frames of motors, splice boxes, and electric compartments only through proper fittings and shall be securely clamped to prevent chafing of the insulation and to prevent strain on the electric connections. In addition, when insulated conductors pass through metal frames, the holes shall be substantially bushed with insulating bushings.

§ 77.506 Electric equipment; short-circuit and overload protection.

(a) Except as provided in paragraph (b) of this section, automatic circuit breaking devices or fuses shall be installed so as to provide short-circuit and overload protection for all electric equipment. Such automatic circuit-breaking devices or fuses shall conform to the requirements for protection of electric equipment as specified in the National Electrical Code as follows:

(1) For equipment installed before [the effective date of this section]—the National Electrical Code, 1968, 1971, or 1975.

(2) For equipment installed after [the effective date of this section]—the National Electrical Code, 1975.

(b) Motors driving single or multiple direct-current generators, supplying a system operating on a cyclic load basis, do not require running overcurrent protection, *Provided*, That the thermal rating of the alternating-current drive motor cannot be exceeded under any operating condition; however, short-circuit and locked-rotor protection shall be provided for such motors.

§ 77.507 Electric equipment; switches.

All electric equipment shall be provided with switches or other controls that are safely designed, constructed, installed, and maintained. The voltage of alternating-current remote motor control circuits that are installed external to the controller enclosure shall not exceed 150 volts unless the circuit is installed in metal conduit. Stop switches shall be provided at the operating controls of all electric equipment.

§ 77.508 Electrical rating; switches, fuses, circuit breakers and controllers.

All switches, fuses, circuit breakers, and controllers shall have adequate interrupting capacity and shall have voltage and current ratings consistent with the voltage and current ratings of the circuits in which they are installed.

§ 77.509 Identification.

Disconnecting devices, power switches, circuit breakers, controllers, control switches and push buttons shall be marked to show which circuit they control, unless identification can be made readily by location.

§ 77.510 Lightning arresters for ungrounded exposed power conductors, control lines and communication wires.

(a) All ungrounded, unshielded power conductors, control lines and communication wires that are exposed to lightning shall be equipped with suitable lightning arresters which are adequately installed and connected to a low-resistance grounding medium in accordance with § 77.519, except that lightning arresters protecting control lines and communication wires may be grounded in accordance with the requirements of Section 800–31(b) of the National Electrical Code, 1975.

(b) Lightning arresters protecting exposed overhead conductors entering buildings shall be provided near the point where each such conductor enters the building.

§ 77.511 Resistors; location and guarding.

Resistors, heaters, and rheostats shall be located so as to minimize fire hazards, and, where necessary, shall be provided with guards to prevent personal contact.

§ 77.512 Guarding of electric equipment.

(a) Live parts of low- and medium-voltage electric equipment energized at 50 volts or more shall be guarded against accidental contact by installation in cabinets or enclosures or by any of the following means:

(1) By location in a locked room, vault, or similar enclosure that is accessible only to qualified persons.

(2) By suitable permanent, substantial partitions or screens so arranged that only qualified persons will have access to the space within reach of the live parts. Any openings in such partitions or screens shall be so sized and located that persons are not likely to come into accidental contact with the live parts or to bring conducting objects into contact with them.

(3) By location on a suitable balcony, gallery, or platform so elevated and arranged as to be accessible only to qualified persons.

(4) By elevation of 8 feet or more above the floor or other working surface.

(b) In locations where electric equipment would be exposed to physical damage, enclosures or guards shall be so arranged and of such strength as to prevent such damage.

(c) Entrances to rooms and other guarded locations containing exposed live parts shall be marked with conspicuous warning signs forbidding unqualified persons to enter.

(d) Enclosures shall be kept closed and guards shall be kept in place at all times such equipment is energized except when testing or troubleshooting is being performed.

§ 77.513 Insulating mats.

Insulating mats shall be kept in front of the following:

(a) All switchboards energized at more than 150 volts.

(b) All linestarters, fuse boxes, and other switchgear containing renewable components energized at more than 150 volts and installed less than 8 feet above the floor or other working surface at stationary installations or on board self-propelled electric equipment.

(c) All enclosures containing readily accessible parts which are energized at more than 150 volts and installed less than 8 feet above the floor or other working surface at stationary installations or on board self-propelled electric equipment. Readily accessible parts are those parts contained in an enclosure to which a person can gain access by such methods as opening hinged doors or lids or removing latched covers.

§ 77.514 Switchboards; passageways and clearance.

Switchboards in stationary installations which require back access for inspection, adjustment, or repair shall be installed to provide passageways or lanes of travel which permit access to the back of the switchboard from both directions.

§ 77.515 Power conductors, signal conductors and control circuit conductors; insulation and guarding.

(a) Except as specified in paragraphs (a)(1) through (a)(6) of this section, all power conductors, signal conductors and control circuit conductors shall be insulated. Such insulation shall have a rating not less than the nominal voltage of the circuit in which the conductor is installed.

(1) Trolley wires;

(2) Trolley feeder wires;

(3) Overhead powerlines installed so as to provide the minimum vertical clearance as specified in Section 232 of the National Electrical Safety Code, 1973;

(4) High-voltage power conductors installed in accordance with the provisions §§ 77.804(b)(5) or 77.804(b)(6);

(5) Grounded service entrance conductors permitted to be uninsulated by the exception in Section 230–40(a) of the National Electrical Code, 1975; and

(6) Signal conductors and control circuit conductors energized at 40 volts or less.

(b) Trolley wires, trolley feeder wires, uninsulated signal conductors and uninsulated control circuit conductors shall be adequately guarded at all points where men are required to work or pass regularly under the wires and at all mantrip stations.

(c) Temporary guards shall be provided where trackmen and other persons are required to work in proximity to energized trolley wires and trolley feeder wires.

(d) An authorized representative of the Secretary may specify other conditions where trolley wires, trolley feeder wires and uninsulated signal conductors and control circuit conductors shall be adequately protected to prevent contact by any person, or may require the use of improved methods to prevent such contact.

§ 77.516 Electric wiring and equipment; installation and maintenance.

(a) Except as otherwise provided in this part, all electric wiring and equipment installed in stationary installations after June 30, 1971, and before [the effective date of this section], shall meet the requirements of the National Electrical Code, 1971 or 1975.

(b) Except as otherwise provided in this part, all electric wiring and equipment installed in stationary installations after [the effective date of this section] shall meet the requirements of the National Electrical Code, 1975.

§ 77.516–1 Class I hazardous locations; surface facilities.

(a) The inside of all enclosed coal storage facilities, such as coal silos and surge bins, shall be classified as Class I, Division I, locations.

(b) (1) The inside of enclosed rooms or other areas which are over, under, or adjacent to enclosed coal storage facilities, such as enclosed belt transfer points on top of coal silos and tunnels containing equipment beneath coal stockpiles, shall be classified as Class I, Division I, locations. Tunnels beneath coal silos and coal storage areas through which railroad trains pass are not considered to be Class I areas, provided the length of the tunnel is less than 125 feet and the tunnel is open at both ends.

(2) The term adjacent, as used in this section, means any two enclosed areas which have one or more surfaces in common.

(c) Locations in facilities or areas specified in paragraph (b) of this section which do not contain coal handling, storage, or processing equipment shall not be classified Class I, Division I, locations if Type X purged in accordance with National Fire Protection Association publication NFPA No. 496, "Purged and Pressurized Enclosures for Electrical Equipment, 1971."

§ 77.516–2 Electric wiring and equipment in Class I hazardous locations.

(a) Electric wiring and equipment in Class I, Division I, locations shall be installed and maintained in accordance with the following:

(1)(i) For wiring and equipment installed after June 30, 1971 and before (the effective date of this section), Article 501 of the National Electrical Code, 1971 or 1975;

(ii) For wiring and equipment installed after (the effective date of this section), Article 501 of the National Electrical Code, 1975; or

(2) Enclosed areas which contain electric wiring and equipment shall be ventilated and maintained in accordance with the following:

(i) A forced mechanical ventilation system which will prevent the methane content in the enclosed area from exceeding 1.0 volume per centum; and

(ii) A continuous methane-monitoring device shall be installed to deenergize all electric wiring and equipment when such monitor is not operating properly and to give a warning automatically when the concentration of methane reaches a maximum percentage which shall not be more than 1.0 volume per centum of methane. Such monitor shall deenergize, automatically, electric wiring and equipment when the concentration of methane reaches a maximum percentage which shall not be more than 2.0 volume per centum of methane except that wiring and equipment installed and maintained as specified in paragraph (a)(1) of this section may remain energized.

(b) All electric wiring and equipment that is required by Article 501 of the National Electrical Code to be approved for Class I locations shall be listed by Underwriters' Laboratories, Inc. or Factory Mutual, Inc., for Class I, Group D, locations or certified or approved as explosionproof or permissible by MESA under this title.

§ 77.516–3 Class II hazardous locations; surface facilities.

(a) The inside of enclosed coal storage facilities and the inside of enclosed coal processing equipment shall be classified as Class II, Division I, locations.

(b) Rooms or enclosures housing coal handling or processing equipment shall be classified as Class II, Division II, locations.

§ 77.516–4 Electric wiring and equipment in Class II hazardous locations.

(a) Electric wiring and equipment in Class II, Division I and II, locations shall be installed and maintained in accordance with the following:

(1) For electric wiring and equipment installed after June 30, 1971, and before the effective date of this section, Article 502 of the National Electrical Code, 1971, or 1975;

(2) For electric wiring and equipment installed after the effective date of this section, Article 502 of the National Electrical Code, 1975.

(b) All electric wiring and equipment that is required by Article 502 of the National Electrical Code to be approved for Class II locations shall be listed by Underwriters' Laboratories, Inc., or Factory Mutual, Inc., for a Class II, Group F, location or certified or approved as explosion-proof or permissible by MESA under this title.

§ 77.517 Protection of electric wiring and equipment.

All electric wiring except trailing cables and portable feeder cables shall be installed in a workmanlike manner, protected against mechanical damage, securely fastened in place, and suitable for the environment in which they are installed. All raceways, fittings, boxes, cabinets and enclosures shall be protected against mechanical damage, securely fastened in place and suitable for the environment in which they are installed.

§ 77.518 Equipment marking.

Stationary electric utilization equipment purchased or rebuilt after the effective date of this section shall be provided with a plate, which indicates the manufacturer's name, rated voltage, full-load current, duty cycle, and, if applicable, horsepower.

§ 77.519 Low-resistance grounding medium.

(a) "Low-resistance grounding medium" means made electrodes, buried metallic piping system, metal framework of a building, well or borehole casing, steel piling or other buried metal structure having a total resistance to ground of not more than 5 ohms. A low-resistance grounding medium may consist of more than one ground field provided:

(1) At least one ground field shall be installed at each location a low-resistance grounding medium is required;

(2) The resistance to ground of each ground field shall not exceed 25 ohms; and

(3) The parallel resistance to ground of all ground fields which serve as a single low-resistance grounding medium shall not exceed 5 ohms.

(b) Low-resistance grounding mediums shall be measured at the time of installation and at least annually thereafter to insure a sufficiently low resistance to ground has been achieved and is being maintained. The results of such measurements shall be recorded and made available to the authorized representative of the Secretary.

§ 77.520 Ground wire.

"Ground wire" means a copper or other corrosion-resistant wire which shall have a breaking strength and a direct-current resistance in accordance with the following:

(a) When the power conductor is smaller than No. 6 AWG, the ground wire shall have a breaking strength no less than and a direct-current resistance no greater than that of the power conductor.

(b) When the power conductor is No. 6 AWG or larger, the ground wire shall have a breaking strength no less than and a direct-current resistance no greater than a wire of the same material as the power conductor and a cross-sectional area of one-half that of the power conductor.

(c) When a ground wire is used to ground the metallic shielding of a power conductor or cable, the ground wire shall have a breaking strength no less than and a direct-current resistance no greater than that of a wire of the same material and the same cross-sectional area as that of the shielding.

§ 77.521 Grounding conductor.

(a) A grounding conductor shall be permanent and continuous, shall have current-carrying capacity at least equal to the wire specified in § 77.520, shall be able to conduct safely any currents likely to be imposed on it, and shall have impedance sufficiently low to facilitate the operation of the ground fault protective devices in the circuit under ground fault conditions. Such grounding conductor shall consist of:

(1) A properly sized copper or other corrosion-resistant wire which meets the requirements of § 77.520;

(2) Properly bonded rigid metal conduit; or

(3) Properly bonded electrical metallic tubing; or

(4) The structural metal frame of a building or machine, provided the equipment is solidly connected to the metal frame.

§ 77.522 Guy wires; grounding.

Guy wires from poles supporting power lines shall be securely connected to the system grounding medium or shall be provided with insulators installed near the pole end.

§ 77.523 Use of grounding connectors.

If ground wires are attached to grounded power conductors, separate clamps, suitable for such purpose, shall be used and installed to provide a solid connection.

§ 77.524 Protection other than grounding.

Methods other than grounding which provide no less effective protection may be approved by an authorized representative of the Secretary. Such methods shall not be used unless so approved.

§ 77.525 Incorporation by reference.

In accordance with 5 U.S.C. 552(a)(1), the publications to which references are made in this subpart are hereby incorporated by reference and made a part hereof. The incorporated publications are available for examination at each Coal Mine Health and Safety District and Subdistrict Office of MESA. ASTM publications are also available from the American Society for Testing and Materials, 1916 Race St., Philadelphia, Pa. 19103. The National Electrical Codes and NFPA publications are also available from the National Fire Protection Association, 470 Atlantic Ave., Boston, Mass. 02210. IPCEA publications are also available from the Insulated Power Cable Engineers Association, 192 Washington Street, Belmont, Mass. 02178. The National Electrical Safety Code is also available from the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th St., New York, N.Y. 10017. Underwriters' Laboratories publications are also available from Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago, Ill. Factory Mutual publications are also available from Factory Mutual Research Corp., 1151 Boston-Providence Turnpike, Norwood, Mass. 02062. Incorporation by reference provisions approved by the Director of the Federal Register on (date to be inserted prior to final rulemaking).

Subpart G—Circuits to Portable and Self-Propelled Electric Equipment

§ 77.600 Definitions.

For the purposes of this part:

(a) "Trailing cable circuit" means a circuit which supplies power to a single unit of self-propelled electric equipment;

(b) "Trailing cable" means any power cable which is used as part or all of a trailing cable circuit;

(c) "Feeder cable circuit" means a circuit which supplies power to two or more units of self-propelled electric equipment or one or more units of portable electric equipment; and

(d) "Portable feeder cable" means any power cable which is used as part or all of a feeder cable circuit.

§ 77.601 Trailing cable circuits; protection.

Except as provided in § 77.601–1, each trailing cable circuit shall be protected by an individual circuit breaker which shall interrupt each ungrounded power conductor and shall be equipped with devices to provide short-circuit and ground-fault protection in accordance with the following:

(a) Short-circuit protection shall be provided by instantaneous overcurrent devices which shall be adjusted to trip the circuit breaker when the current in any power conductor exceeds the value specified in paragraph (a)(1) or (a)(2) of this section, whichever is lower:

(1) 115 percent of the maximum starting current for the unit of self-propelled electric equipment or 115 percent of the peak load current for the unit of self-propelled electric equipment, whichever is higher; or

(2) 60 percent of the lowest value of bolted, line-to-line short-circuit current at any point in the circuit.

(b) Devices providing ground-fault protection for resistance-grounded circuits shall be adjusted to trip the circuit breaker when the ground-fault current exceeds 50 percent of the current rating of the grounding resistor.

(c) Devices providing ground-fault protection for solidly grounded single-phase and solidly grounded direct-current circuits shall be adjusted to trip the circuit breaker when the ground-fault current exceeds 50 percent of the lowest value of bolted ground-fault current at any point in the circuit.

(d) Devices providing ground-fault protection for ungrounded single-phase and ungrounded direct-current circuits shall be adjusted to trip the circuit breaker when more than 15 milliamperes of current flows from an ungrounded power conductor to earth.

§ 77.601–1 Dual element fuses; trailing cable circuits.

Dual element fuses are acceptable as providing short-circuit and ground-fault protection for a solidly grounded low- or medium-voltage single-phase or solidly grounded direct-current trailing cable circuit provided:

(a) One fuse is installed in each ungrounded power conductor;

(b) Each fuse has adequate interrupting capacity and voltage and current ratings consistent with the voltage and current ratings of the circuit in which it is installed; and

(c) The rating of the fuse does not exceed the ampacity of the power conductor in the circuit with the lowest ampacity.

§ 77.602 Feeder cable circuits; protection.

Except as provided in § 77.602–1, feeder cable circuits shall be protected by circuit breakers which shall interrupt each ungrounded power conductor and shall be equipped with devices to provide short-circuit, overload and ground-fault protection in accordance with the following:

(a) Devices providing short-circuit and overload protection for high-voltage feeder cable circuits shall be adjusted to trip the circuit breaker when the current in any power conductor exceeds the value specified in paragraph (a)(1) or (a)(2) of this section, whichever is lower:

(1) 125 percent of the ampacity of the power conductor in the circuit with the lowest ampacity.

(2) 50 percent of the lowest value of bolted phase-to-phase short-circuit current at any point in the circuit.

(b) Devices providing short-circuit and overload protection for low- and medium-voltage feeder cable circuits shall be set or adjusted in accordance with the National Electrical Code, 1975.

(c) Devices specified in paragraphs (a) and (b) of this section to trip the circuit breakers before any power conductor in the circuit sustains thermal damage due to short-circuit current.

(d) One circuit breaker may be used to provide short-circuit and overload protection for two or more feeder cable circuits provided the short-circuit and overload devices are adjusted to provide short-circuit and overload protection for each circuit in accordance with the requirements of this section.

(e) Devices providing ground-fault protection for resistance-grounded feeder cable circuits shall be adjusted to trip the circuit breaker when the ground-fault current exceeds 50 percent of the current rating of the grounding resistor.

(f) Devices providing ground-fault protection for solidly grounded single-phase and solidly grounded direct-current feeder cable circuits shall be adjusted to trip the circuit breaker when the ground-fault current exceeds 50 percent of the lowest value of bolted ground-fault current at any point in the circuit.

(g) Devices providing ground-fault protection for ungrounded single-phase and ungrounded direct-current feeder cable circuits shall be adjusted to trip the circuit breaker when more than 15 milliamperes flows from an ungrounded power conductor to earth.

(h) One circuit breaker may be used to provide ground-fault protection for two or more feeder cable circuits provided the ground-fault device is adjusted to provide ground-fault protection for each circuit in accordance with the requirements of this section.

§ 77.602–1 Dual element fuses; feeder cable circuits.

Dual element fuses are acceptable as providing short-circuit, overload and ground-fault protection for a solidly grounded low- or medium-voltage single-phase or solidly grounded direct-current feeder cable circuit provided:

(a) One fuse is installed in each ungrounded power conductor.

(b) Each fuse has adequate interrupting capacity and voltage and current ratings consistent with the voltage and current ratings of the circuit in which it is installed.

(c) The rating of the fuse does not exceed the ampacity of the power conductor in the circuit with the lowest ampacity.

§ 77.603 Ground check circuits.

(a) All low- and medium-voltage three-phase resistance grounded circuits and high-voltage resistance grounded circuits supplying power to portable or self-propelled equipment shall be equipped with a ground check circuit to monitor continuously the grounding circuit to assure continuity between the grounded side of the grounding resistor and the frames of the portable and self-propelled equipment.

(b) Except as provided in § 77.603–1 the ground check circuit shall be fail safe.

(c) Except as provided in § 77.603–2 the ground check circuit shall employ a ground check wire.

(d) The ground check circuit shall cause the circuit breaker to trip when any of the following occur:

(1) The ground check wire is broken.

(2) Either the ground wire is broken at any point, or the impedance of the grounding circuit increases beyond the amount necessary to cause:

(i) a 40-volt drop in the grounding circuit external to the grounding resistor under fault conditions for low- and medium-voltage resistance-grounded circuits, or

(ii) a 100-volt drop in the grounding circuit external to the grounding resistor under fault conditions for high-voltage resistance-grounded circuits.

(e) The maximum voltage used for ground check circuits shall not exceed 40 volts for low- and medium-voltage resistance-grounded circuits, or 96 volts for high-voltage resistance-grounded circuits.

(f) When the ground check circuit employs an electro-mechanical relay to trip the circuit breaker, the relay shall be normally energized.

(g) A time-delay device may be used to delay circuit breaker tripping for not more than 15 cycles only for the purpose of preventing unnecessary circuit breaker tripping when power is restored after an interruption.

(h) The ground check wire and the ground wire shall be attached to the frames of portable and self-propelled equipment by means of separate connections.

§ 77.603–1 Ground check circuits other than fail safe ground check circuits; approval.

An operator may apply to the Assistant Administrator—Technical Support, MESA, Room 901, 4015 Wilson Boulevard, Arlington, Virginia 22203, for approval of a ground check circuit other than a fail safe ground check circuit. The Assistant Administrator—Technical Support may approve such circuit if he determines that the ground check circuit is reliable and otherwise meets requirements of § 77.603.

§ 77.603–2 Ground check circuits not employing a ground check wire; approval.

An operator may apply to the Assistant Administrator—Technical Support, MESA, Room 901, 4015 Wilson Boulevard, Arlington, Virginia 22203, for approval of a ground check circuit which does not employ a ground check wire. The Assistant Administrator—Technical Support may approve such circuit if he determines that the ground check circuit does not pose a hazard to miners and otherwise meets the requirements of § 77.603.

§ 77.604 High-voltage circuit breakers; examination, testing and adjustment.

(a) Circuit breakers required by §§ 77.601 and 77.602 which are installed in high-voltage circuits shall be examined monthly. Such examination shall include observation of all readily accessible components of the circuit breaker and its auxiliary devices.

(b) Circuit breakers required by §§ 77.601 and 77.602 which are installed in high-voltage circuits before [the effective date of this section] shall be tested:

(1) Not later than 6 months after [the effective date of this section] in accordance with paragraphs (d)(1), (e) and (f) of this section, and

(2) At least annually thereafter in accordance with paragraphs (d)(2), (e) and (f) of this section,

(c) Circuit breakers required by §§ 77.601 and 77.602 which are installed in high-voltage circuits after [the effective date of this section] shall be tested:

(1) At the time of installation in accordance with paragraphs (d)(1), (e) and (f) of this section, and

(2) At least annually thereafter in accordance with paragraphs (d)(2), (e) and (f) of this section.

(d) Short-circuit and overload devices used in conjunction with a high-voltage circuit breaker shall be tested as follows:

(1) The initial testing required by paragraphs (b)(1) and (c)(1) of this section shall include testing of all short-circuit and overload relays to verify operation at the indicated settings, or of all over current trip coils to verify operation at indicated current ratings by passing no less than the current necessary for relay pickup or series trip coil operation through the poles of the circuit breaker. The circuit breaker shall be tripped by electrically or manually operating the overcurrent devices.

(2) The annual testing required by paragraphs (b)(2) and (c)(2) of this section shall include testing all short-circuit and overload relays to verify operation at the indicated settings, or of all over-current trip coils to verify operation at indicated current ratings. If relays are used, the circuit from the current transformer secondary to the short-

circuit and overload relay terminals shall be tested to verify continuity. The circuit breaker shall be tripped by electrically or manually operating the overcurrent devices.

(e) Ground-fault devices used in conjunction with a high-voltage circuit breaker shall be tested as follows: (1) For the initial and annual testing required by paragraphs (b) and (c) of this section, the circuit breaker shall be tripped by passing no more than 60 percent of the current rating of the grounding resistor through the ground-fault current transformer, or a phase current transformer when residual ground-fault tripping is used. The grounding resistor shall be tested to insure proper ohmic value and continuity. If potential ground-fault tripping is used, the circuit breaker shall be tripped by impressing a voltage on the ground-fault relay equal to no more than 60 percent of the voltage that would appear at the relay terminals during a ground-fault. In addition the transformer coil continuity and ratio shall be checked. The grounding resistor shall be tested to insure proper ohmic value and continuity.

(f) Ground check circuits used in conjunction with a high-voltage circuit breaker shall be tested as follows: (1) For the initial and annual testing required by paragraphs (b) and (c) of this section, the circuit breaker trip circuit shall be activated by breaking the continuity of the ground check conductor at the extreme end of the monitoring circuit, and either breaking the ground wire at any point between the grounded side of the resistor and the equipment being served, or increasing the resistance of the grounding circuit to that amount necessary to cause a voltage drop in the grounding circuit of not more than 100 volts under fault conditions.

(g) Repairs or adjustments as are indicated by such examinations and tests shall be carried out immediately. All relays shall be adjusted to plus or minus 10 percent of the indicated setting.

(h) An authorized representative of the Secretary may require additional testing or adjusting of circuit breakers and associated components.

§ 77.604–1 Low- and medium-voltage circuit breakers; examination, testing and adjustment.

(a) Circuit breakers required by §§ 77.601 and 77.602 which are installed in low- and medium-voltage circuits shall be examined monthly. Such examination shall include visual observation of all readily accessible components of the circuit breaker and its auxiliary devices.

(b) Circuit breakers required by §§ 77.601 and 77.602 which are installed in low and medium-voltage circuits before [the effective date of this section] shall be tested not later than 6 months after [the effective date of this section] and at least every 6 months thereafter. Such testing shall be performed in accordance with paragraph (d) of this section.

(c) Circuit breakers required by §§ 77.601 and 77.602 which are installed in low- and medium-voltage circuits after [the effective date of this section] shall be tested at the time of installation, and at least every 6 months thereafter. Such testing shall be performed in accordance with paragraph (d) of this section.

(d) For the tests required by paragraphs (b) and (c) of this section, the circuit breaker shall be tripped by:

(1) Passing no more than 60 percent of the current rating of the grounding resistor through the ground-fault current transformer;

(2) Breaking the continuity of the ground-check conductor at the extreme end of the monitoring circuit; and

(3) Either breaking the ground conductor at any point between the grounded side of the resistor and the equipment being served, or increasing the resistance of the grounding circuit to that amount necessary to cause a voltage drop in the grounding circuit of not more than 40 volts under fault conditions.

(e) Repairs or adjustments as are indicated by such examination and tests shall be carried out immediately. All relays shall be adjusted to plus or minus 10 percent of the indicated setting.

(f) An authorized representative of the Secretary may require additional testing or adjusting of circuit breakers and associated components.

§ 77.604–2 Qualified person.

Examinations and tests required by §§ 77.604 and 77.604–1 shall be made by a qualified person.

§ 77.604–3 High-, medium- and low-voltage circuit breakers; record of examination, testing and adjustment.

The operator shall maintain a written record of each examination and test of all circuit breakers and their associated components. Such records shall include the name of the examiner and date of examination, and shall be signed by the official responsible for maintaining the circuit breakers in safe operating condition. Such records shall be made available to an authorized representative of the Secretary and an authorized representative of the miners of such mine.

§ 77.605 Disconnecting devices.

(a) Disconnecting devices shall be installed in each trailing cable circuit at a distance of not more than 40 feet from each circuit breaker required by § 77.601.

(b) Disconnecting devices shall be installed in the trailing cable circuit not more than 3,000 feet from self-propelled equipment, unless such equipment is equipped with a remote-control switch which can be used to remove power from the equipment in case of emergency by tripping the circuit breaker required by § 77.601.

(c) Disconnecting devices shall be installed in each feeder cable circuit within 40 feet from the beginning of such feeder cable circuit.

(d) Disconnecting devices shall be designed so that it can be determined by visual observation that the power is disconnected.

§ 77.606 Trailing cable circuits and feeder cable circuits; ampacity requirements.

The required ampacity of all power conductors installed in trailing cable circuits and feeder cable circuits shall be as follows:

(a) The required ampacity of all power conductors installed in a trailing cable circuit shall not be less than the maximum average current demand for the connected load for a 15-minute-period.

(b) The required ampacity of all power conductors installed in a high-voltage feeder cable circuit is not specified.

(c) The required ampacity of all power conductors installed in a low- or medium-voltage feeder cable circuit shall be as specified in the National Electrical Code, 1975.

§ 77.606–1 Trailing cable circuits and feeder cable circuits; ampacity ratings.

The ampacity ratings of all power conductors installed in trailing cable circuits and feeder cable circuits shall be determined in accordance with the following:

(a) The ampacity ratings of trailing cables and portable feeder cables shall be as specified in the standards of the Insulated Power Cable Engineers Association (IPCEA) as follows:

Insulation rating	Table	IPCEA standard
75° C	8–1	S–19–81
90° C	G–1	S–68–516

(b) The ampacity ratings of power conductors other than trailing cables and portable feeder cables shall be as specified in § 77.503–2.

§ 77.607 Trailing cables and portable feeder cables; requirements.

(a) High-voltage trailing cables and high-voltage portable feeder cables shall be equipped with metallic shielding around each power conductor. Such shielding shall meet or exceed the coverage requirements specified in Section 7.2.16.2 or Section 7.2.16.3 of Insulated Power Cable Engineers Association Publication Number S–68–516, 1976. All such cables shall be equipped with one or more ground wires. The combined cross-sectional area of the ground wires and shielding shall not be less than that required by § 77.520.

(b) Low- and medium-voltage trailing cables and low- and medium-voltage portable feeder cables purchased after [the effective date of this section] supplying power to three-phase equipment shall be equipped with metallic shielding around each power conductor. Such shielding shall meet or exceed the coverage requirements specified in Section 7.2.16.2 or Section 7.2.16.3 of Insulated Power Cable Engineers Association Publication Number S–68–516, 1976. All such cables shall be equipped with one or more

ground wires. The combined cross-sectional area of the ground wires and shielding shall not be less than that required by § 77.520.

(c) Low- and medium-voltage trailing cables and low- and medium-voltage portable feeder cables purchased before [the effective date of this section] supplying power to three-phase equipment shall be equipped with one or more ground wires. The cross-sectional area of the ground wires shall not be less than that required by § 77.520.

(d) Low- and medium-voltage trailing cables and low- and medium-voltage portable feeder cables purchased before [the effective date of this section] supplying power to single phase equipment shall be equipped with one or more ground wires. The cross-sectional area of the ground wires shall not be less than that required by § 77.520.

§ 77.608 Trailing cables and portable feeder cables; splices, insulation and repair.

(a) Splices made in trailing cables and portable feeder cables shall meet the requirements of § 77.504.

(b) Damaged trailing cables and portable feeder cables shall be repaired in a workmanlike manner so as to exclude moisture and to provide at least the same degree of protection as provided by the remainder of the cable.

(c) Prior to splicing or making repairs to trailing cables and portable feeder cables, the disconnecting device required by § 77.605 shall be locked out and suitably tagged by the persons who perform such work, except that in cases where locking out is not possible, such devices shall be opened and suitably tagged by such persons. Locks and tags shall be removed only by the persons who installed them or, if such persons are not available, by persons authorized by the operator or his agent.

§ 77.609 Securing of trailing cables and portable feeder cables.

Trailing cables and portable feeder cables shall be secured to self-propelled or portable equipment to protect the cables from damage and to prevent strain on the electrical connections.

§ 77.610 Mechanical protection of trailing cables and portable feeder cables.

(a) Trailing cables and portable feeder cables shall be protected to prevent damage by equipment and placed to afford reasonable protection against rock slides and other falling objects.

(b) Trailing cables and portable feeder cables shall not be moved with self-propelled equipment unless cable slings, sleds, or equivalent protection is provided.

§ 77.611 Energized trailing cables and portable feeder cables; handling.

(a) Persons handling trailing cables and portable feeder cables, energized at more than 150 volts, shall wear protective gloves. Such gloves shall meet American Society for Testing and Materials (ASTM), "Standard Specification for Rubber Insulating Gloves" (D120–70) and shall be rated in accordance with the following:

Normal circuit voltage:	*ASTM class glove*
151 to 750	0
751 to 10,000	1
10,001 to 15,000	2
15,001 to 20,000	3
20,001 to 35,000	4

(b) Protective gloves, worn while handling energized trailing cables and portable feeder cables, shall be inspected for defects before each use. Defective gloves shall not be used.

(c) Protective gloves, worn while handling energized high-voltage trailing cables and portable feeder cables, shall be tested in accordance with § 77.806–6.

§ 77.612 Cable couplers; requirements.

(a) Cable couplers that are used in three-phase circuits shall be of the three-phase type and enclosed in a full metallic shell.

(b) Cable couplers shall be adequate for the intended current and voltage.

(c) The metallic shell of cable couplers shall be grounded to the ground wire in the cable.

(d) Cable couplers shall be constructed in such manner so that the ground-check monitoring conductor, when required, will break first and the ground wire will break last when being uncoupled.

§ 77.613 Cable connection boxes; requirements.

(a) Cable connection boxes shall be of substantial construction and designed to guard all energized parts from personal contact.

(b) The box entrance lid or door shall be interlocked so that the circuit will be deenergized when the lid or door is opened.

(c) The current-carrying parts shall be deenergized and grounded before any work is performed inside such boxes.

§ 77.614 Trailing cables and portable feeder cables; connections.

Plugs and connectors in trailing cables and portable feeder cables energized at more than 150 volts shall not be connected or disconnected while the circuit is energized.

§ 77.615 Incorporation by reference.

In accordance with 5 U.S.C. 552(a)(1), the publications to which references are made in this subpart are hereby incorporated by reference and made a part hereof.

The incorporated publications are available for examination at each Coal Mine Health and Safety District and Subdistrict Office of MESA. The National Electrical Codes are also available from the National Fire Protection Association, 470 Atlantic Ave., Boston, Mass. 02210. IPCEA publications are also available from the Insulated Power Cables Engineers Association, 192 Washington St., Belmont, Mass. 02178. ASTM publications are also available from the American Society for Testing and Materials, 1916 Race St., Philadelphia, Pa. 19103. Incorporation by reference provisions approved by the Director of the Federal Register on (date to be inserted prior to final rulemaking).

Subpart H—Direct Current Circuits

§ 77.700 Protection of direct current circuits.

All direct current circuits, except those circuits protected under §§ 77.601, 77.602 and 77.1800 shall be protected as follows:

(a) Resistance-grounded and solidly grounded direct current circuits shall be protected against short-circuit, overload and ground fault by circuit breakers equipped with devices to provide such protection, or by fuses of the correct type and capacity.

(b) Ungrounded direct current circuits shall be protected against short-circuit and overload by circuit breakers equipped with devices to provide such protection, or by fuses of the correct type and capacity. Circuits supplied power from an ungrounded direct current system shall be protected against ground-fault by a circuit breaker equipped with a device to provide such protection, or a ground-fault indicator shall be installed that will give visual warning at an attended location upon occurrence of a ground-fault on any circuit supplied power from such system. A ground-fault condition shall not be allowed to exist on an energized circuit for longer than 24 hours.

§ 77.700–1 Short-circuit and overload protection; requirements.

Where circuit breakers or fuses provide short-circuit and overload protection for direct current circuits, such circuit breakers or fuses shall conform to the requirements for protection of circuits as specified in the National Electrical Code as follows:

(a) For circuits installed before [the effective date of this section]—the National Electrical Code, 1968, 1971, or 1975.

(b) For circuits installed after [the effective date of this section]—the National Electrical Code, 1975.

§ 77.700–2 Ground-fault protection; requirements.

(a) Where a circuit breaker provides ground-fault protection for a resistance-grounded or a solidly grounded direct current circuit, such circuit breaker shall be equipped with a device which shall be adjusted to trip the circuit breaker when the ground-fault current in any ungrounded power conductor exceeds 50 percent of the lowest value of bolted ground-fault current at any point in the circuit.

(b) Where a circuit breaker provides ground-fault protection for an ungrounded direct current circuit, such circuit breaker shall be equipped with a device which shall be adjusted to trip the circuit breaker when the line-to-ground voltage on any power conductor decreases to less than 50 percent of the nominal system voltage.

(c) Where fuses provide ground-fault protection for a resistance-grounded or solidly grounded direct current circuit, one fuse shall be installed in each un-

grounded power conductor. Each fuse shall have a current rating not exceeding 40 percent of the lowest value of bolted ground-fault current at any point in the circuit.

§ 77.700–3 Ground-fault indicator; requirements.

Where a ground-fault indicator is used to provide ground-fault indication for an ungrounded direct current circuit, it shall be adjusted to give a visual indication when the line-to-ground voltage on any power conductor decreases to less than 50 percent of the nominal system voltage.

§ 77.701 Direct current systems; system and enclosure grounding.

(a) *System grounding.* All direct current systems:

(1) Shall be installed and maintained ungrounded, or

(2) Shall have one polarity of the generator or rectifier solidly grounded to a low-resistance grounding medium at the generator or rectifier, or

(3) Shall have the midpoint of the 3-wire generator solidly grounded to a low-resistance grounding medium at the generator, or

(4) Shall have the neutral of the alternating current source which supplies power to the rectifier solidly grounded to a low-resistance grounding medium at the alternating current power source, or

(5) Shall have the neutral of the alternating current source which supplies power to the rectifier grounded through a suitable grounding resistor to a low-resistance grounding medium at the alternating current power source.

(b) *Enclosure grounding.* Metallic frames and other metallic enclosures of electric equipment and circuits supplied power from direct current systems shall be grounded in accordance with the following:

(1) *Ungrounded systems.* A grounding conductor which meets the requirements of § 77.521 shall originate at a low-resistance grounding medium located at the power source. Such grounding conductor shall be connected to the metallic frames and enclosures of the power source, including the rectifier, and shall extend along with the power conductors and serve as the grounding circuit for the metallic frames and other metallic enclosures of all electric equipment and circuits supplied power from the system. The grounding conductor shall also be connected to a low-resistance grounding medium at the service equipment for buildings and other stationary installations.

(2) *Solidly grounded systems.* Except as provided in paragraph (b)(2)(i) of this section, a grounding conductor which meets the requirements of § 77.521 shall originate at the grounded point of the power source. Such grounding conductor shall be connected to the metallic frames and enclosures of the power source, including the rectifier, and shall extend along with the power conductor and serve as the grounding circuit for the metallic frames and other metallic enclosures of all electric equipment and circuits supplied power from the system. The grounding conductor shall also be connected to a low-resistance grounding medium at the service equipment for buildings and other stationary installations.

(i) Metallic frames and other metallic enclosures of electric equipment which is supplied power from a trolley system in which one polarity is grounded to the track rail may be grounded to the track rail or grounded feeder wire. In such installation, a grounding conductor which meets the requirements of § 77.521 shall originate at the track rail or grounded feeder wire and shall extend along with the power conductors and serve as the grounding circuit for the metallic frames and other metallic enclosures of all circuits and equipment supplied power from the circuit.

(3) *Resistance-grounded systems.* A grounding conductor which meets the requirements of § 77.521 shall originate at the grounded side of the grounding resistor. Such grounding conductor shall be connected to the metallic frames and enclosures of the power source, including the rectifier, and shall extend along with the power conductors and serve as the grounding circuit for the metallic frames and other metallic enclosures of all electric equipment and circuits supplied power from the system. The grounding conductor shall also be connected to a low-resistance grounding medium at the service equipment for buildings and other stationary installations.

§ 77.702 Incorporation by reference.

In accordance with 5 U.S.C. 552(a)(1), the publications to which references are made in this subpart are hereby incorporated by reference and made a part hereof. The incorporated publications are available for examination at each Coal Mine Health and Safety District and Subdistrict Office of MESA. The National Electrical Codes are also available from the National Fire Protection Association, 470 Atlantic Ave., Boston, Mass. 02210. Incorporation by reference provisions approved by the Director of the Federal Register on (date to be inserted prior to final rulemaking).

Subpart I—High-Voltage Alternating Current Circuits

§ 77.800 Protection of high-voltage alternating current circuits.

All high-voltage alternating current circuits, except those circuits protected under §§ 77.601, 77.602 and 77.1800, shall be protected as follows:

(a) Resistance-grounded and solidly grounded high-voltage circuits shall be protected against short-circuit, overload and ground-fault by circuit breakers equipped with devices to provide such protection, or by fuses of the correct type and capacity.

(b) Ungrounded high-voltage circuits shall be protected against short-circuit and overload by circuit breakers equipped with devices to provide such protection, or by fuses of the correct type and capacity. Circuits supplied power from an ungrounded high-voltage system shall be protected against ground-fault by a circuit breaker equipped with a device to provide such protection, or a ground-fault indicator shall be installed that will give visual warning at an attended location upon occurrence of a ground-fault on any circuit supplied power from such system. A ground-fault condition shall not be allowed to exist on an energized circuit for longer than 24 hours.

§ 77.800–1 Short-circuit and overload protection; requirements.

(a) Where circuit breakers or fuses provide short-circuit and overload protection for high-voltage circuits installed within portable and self-propelled equipment, high-voltage circuits installed within buildings, and high-voltage services to buildings, such circuit breakers or fuses shall conform to the requirements for protection of circuits as specified in the National Electrical Code as follows:

(1) For circuits installed before [the effective date of this section]—the National Electrical Code, 1968, 1971 or 1975.

(2) For circuits installed after [the effective date of this section]—the National Electrical Code, 1975.

(b) Where a circuit breaker provides short-circuit and overload protection for a high-voltage circuit, except those circuits specified in paragraph (a) of this section, such circuit breaker shall be equipped with devices which shall be adjusted to trip the circuit breaker when the current in any power conductor exceeds the value specified in paragraph (b)(1) or (b)(2) of this section, whichever is lower:

(1) 125 percent of the ampacity of the power conductor in the circuit with the lowest ampacity; or

(2) 50 percent of the lowest value of bolted phase-to-phase short-circuit current at any point in the circuit. Such devices shall be adjusted to trip the circuit breaker before any power conductor in the circuit sustains thermal damage due to short-circuit or overload.

(c) Where fuses provide short-circuit and overload protection for high-voltage circuits, except those circuits specified in paragraph (a) of this section, one fuse shall be installed in each ungrounded power conductor. Each fuse shall have a current rating not exceeding the value specified in paragraph (c)(1) or (c)(2) of this section, whichever is lower:

(1) 100 percent of the ampacity of the power conductor in the circuit with the lowest ampacity; or

(2) 40 percent of the lowest value of bolted phase-to-phase short-circuit current at any point in the circuit.

§ 77.800–2 Ground-fault protection; requirements.

(a) Where a circuit breaker provides ground-fault protection for a resistance-grounded or a solidly grounded high-voltage circuit, such circuit breaker shall be equipped with a device which shall be adjusted to trip the circuit breaker when the ground-fault current in any ungrounded power conductor exceeds 50 percent of the lowest value of bolted

ground-fault current at any point in the circuit.

(b) Where a circuit breaker provides ground-fault protection for an ungrounded high-voltage circuit, such circuit breaker shall be equipped with a device which shall be adjusted to trip the circuit breaker when the line-to-ground voltage on any power conductor decreases to less than 30 percent of the nominal system voltage for a circuit supplied power from a three phase system or 50 percent of the nominal system voltage for a circuit supplied power from a single phase system.

(c) Where fuses provide ground-fault protection for a resistance-grounded or a solidly grounded high-voltage circuit, one fuse shall be installed in each ungrounded power conductor. Each fuse shall have a current rating not exceeding 40 percent of the lowest value of bolted ground-fault current at any point in the circuit.

§ 77.800–3 Ground-fault indicator: requirements.

Where a ground-fault indicator is used to provide ground-fault indication for an ungrounded high-voltage circuit, it shall be adjusted to give a visual indication when the line-to-ground voltage on any power conductor decreases to less than 30 percent of the nominal system voltage for a circuit supplied power from a three phase system, or 50 percent of the nominal system voltage from a circuit supplied power from a single phase system.

§ 77.801 High-voltage alternating current systems supplying power to portable or self-propelled equipment; system and enclosure grounding.

(a) *System grounding.* High-voltage systems supplying power to portable or self-propelled equipment shall contain either a direct or derived neutral which shall be grounded through a suitable grounding resistor to a low-resistance grounding medium at the power source.

(b) *Enclosure grounding.* A ground wire which meets the requirements of § 77.520 shall be connected to the grounded side of the grounding resistor and shall extend along with the power conductors and serve as the grounding circuit for:

(1) The metallic frames and other metallic enclosures of all portable and self-propelled equipment supplied power from the system, and

(2) The metallic enclosures of all circuits which are supplied power from the system and extend to portable and self-propelled equipment.

§ 77.801–1 Grounding resistors; portable and self-propelled equipment.

(a) The grounding resistor required by § 77.801(a) shall be of the proper ohmic value to limit the voltage drop in the grounding circuit external to the resistor to no more than 100 volts under fault conditions.

(b) The ground-fault current rating of the grounding resistor required by § 77.801(a) shall meet the "extended time rating" set forth in American Institute of Electrical Engineers (AIEE) Standard No. 32. Such grounding resistor shall be insulated from ground for a voltage not less than the phase-to-phase voltage of the system in which it is installed.

§ 77.801–2 Grounding medium; portable and self-propelled equipment.

The low-resistance grounding medium required by § 77.801(a) shall be separated from the source transformer substation ground field by at least 25 feet.

§ 77.802 High-voltage alternating current systems supplying power to stationary equipment; system and grounding.

(a) *System grounding.* High-voltage alternating current systems supplying power to stationary equipment shall be grounded in accordance with the following:

(1) The neutral point of wye connected three-phase four-wire systems in which the neutral is used as a power conductor shall be solidly grounded to a low-resistance grounding medium at the power source.

(2) All other three-phase systems:

(i) Shall be installed and maintained ungrounded, or

(ii) Shall be solidly grounded to a low-resistance grounding medium at the power source, or

(iii) Shall contain a direct or derived neutral which shall be grounded through a suitable grounding resistor to a low-resistance grounding medium at the power source.

(3) All single-phase systems shall be installed and maintained ungrounded or shall be solidly grounded to a low-resistance grounding medium at the power source.

(b) *Enclosure grounding.* Except as provided in § 77.802–2, metallic frames and other metallic enclosures of stationary electric equipment and circuits supplied power from high-voltage alternating current three-phase systems shall be grounded in accordance with the following:

(1) *Resistance-grounded systems.* A grounding conductor which meets the requirements of § 77.521 shall be connected to the grounded side of the grounding resistor, and shall extend along with the power conductors and serve as the grounding circuit for the metallic frames and other metallic enclosures of all stationary electric equipment and circuits supplied power from the system. The grounding conductor shall also be connected to a low-resistance grounding medium at the service equipment for buildings and other stationary installations.

(2) *Solidly grounded systems.* Except as provided in paragraphs (b)(2)(i) and (b)(2)(ii) of this section, a grounding conductor which meets the requirements of § 77.521 shall be connected to the grounded point of the power source and shall extend along with the power conductors and serve as the grounding circuit for the metallic frames and other metallic enclosures of all stationary equipment and circuits supplied power from the system. The grounding conductor shall also be connected to a low-resistance grounding medium at the service equipment for buildings and other stationary installations.

(i) Metallic frames and other metallic enclosures of service equipment and circuits may be grounded to the grounded power conductor of the system provided the grounded power conductor meets the requirements of § 77.520 and is connected to a low-resistance grounding medium at the power source and at the service equipment for buildings and other stationary installations. In such installations, a grounding conductor meeting the requirements of § 77.521 shall be connected to the grounded service equipment and shall extend along with the power conductors and serve as the grounding circuit for the metallic frames and other metallic enclosures of all stationary equipment and circuits supplied power from such service equipment.

(ii) Substation enclosures and metallic frames of transformers, circuit breakers and other substation equipment may be grounded to the grounded power conductor of the system provided the grounded power conductor meets the requirements of § 77.520 and is connected to a low-resistance grounding medium at the power source and at the transformer, circuit breaker or substation installation.

(3) *Ungrounded systems.* A grounding conductor which meets the requirements of § 77.521 shall be connected to a low-resistance grounding medium located at the power source and shall extend along with the power conductors and serve as the grounding circuit for the metallic frames and other metallic enclosures of all stationary equipment and circuits supplied power from the system. The grounding circuit shall also be connected to a low-resistance grounding medium at the service equipment for buildings and other stationary installations.

§ 77.802–1 Grounding resistors: stationary equipment.

The ground-fault current rating of the grounding resistor for high-voltage systems supplying power to stationary equipment shall meet the "ten-minute rating" set forth in American Institute of Electrical Engineers (AIEE) Standard No. 32. Such grounding resistor shall be insulated from ground for a voltage not less than the phase-to-phase voltage of the system in which it is installed.

§ 77.802–2 Earth as a grounding conductor.

The District Manager may approve the use of earth as a grounding conductor for metallic frames and other metallic enclosures of stationary equipment and circuits supplied power from high-voltage circuits. Section 77.802–3 sets out the criteria by which the District Manager will be guided in approving earth as a grounding conductor on a mine-by-mine basis. Additional measures may be required.

§ 77.802–3 Criteria for use by the District Manager in approval of earth as a grounding conductor.

(a) An investigation shall be made to assure that the use of earth as a grounding conductor does not create a hazard to miners.

(b) The frames of all equipment should be installed on a ground grid which complies with the requirements of § 77.519 and which serves as the grounding medium for frames of all equipment at that location.

(c) The interrupting time of the circuit breaker or fuses required by § 77.800, and the design of the ground grid should be in accordance with Institute of Electrical and Electronics Engineers (IEEE) No. 80–1971, "Guide for Safety in Alternating-Current Substation Grounding".

(d) Earth should not be used as a power conductor.

(e) The high-voltage system should not supply power to equipment in underground coal mines or to portable or self-propelled equipment.

§ 77.803 Connection of single-phase loads.

Single-phase loads shall be connected phase-to-phase in resistance-grounded systems.

§ 77.804 Guarding of high-voltage equipment, conductors, cables and parts.

(a) High-voltage equipment shall be of the totally enclosed type or shall be:

(1) Located in a room, vault or similar enclosure that is accessible only to qualified persons; or

(2) Elevated 8 feet or more above the floor or other working surface; or

(3) Enclosed within a substantial fence at least 6 feet high and at least 3 feet from any part or wiring.

(b) High-voltage conductors and high-voltage cables, other than trailing cables and portable feeder cables, shall be:

(1) Shielded in accordance with Section 4.1.1.1, 7.5.16.2 or 7.5.16.3 of Insulated Power Cable Engineers Association (IPCEA) Publication Number S–68–516, April 1976; or

(2) Shielded in accordance with Section 4.1.1.3 of Insulated Power Cable Engineers Association Publication Number S–68–516, April 1976, provided the conductor or cable is designed for direct burial and buried at least 30 inches deep; or

(3) Totally enclosed within grounded rigid metal conduit; or

(4) Totally enclosed within a cabinet or other enclosure; or

(5) Guarded so as to prevent contact by persons or objects and protected in accordance with paragraph (a)(1) or (a)(3) of this section; or

(6) Protected in accordance with paragraph (a)(1) or (a)(3) of this section, and installed with a minimum vertical clearance above the floor or other working surface as follows:

Nominal voltage between phases	Minimal vertical clearance of energized parts and conductors	
	Feet	Inches
1,001 to 6,600	8	0
6,601 to 11,000	9	0
11,001 to 22,000	9	3
22,001 to 33,000	9	6
33,001 to 44,000	9	10
44,001 to 66,000	10	5
66,001 to 88,000	11	0
88,001 to 110,000	11	7
110,000 to 132,000	12	2

(c) Live parts of high-voltage equipment shall be protected as prescribed in paragraph (b)(4), (b)(5) or (b)(6) of this section.

(d) Entrances to enclosures specified in paragraphs (a), (b), and (c) of this section shall be locked against unauthorized entry, and marked with conspicuous signs forbidding unqualified persons to enter.

§ 77.804–1 Performing work in proximity to high-voltage conductors and parts.

Where work is to be performed within 4 feet of high-voltage power conductors or live parts of high-voltage equipment, and such work requires the removal of the protection specified in §§ 77.804(b) and 77.804(c) the operator shall comply with the provisions of §§ 77.806 through 77.806–10.

§ 77.805 High-voltage powerlines; clearance above ground.

High-voltage powerlines located above driveways, haulageways, and railroad tracks shall be installed so as to provide the minimum vertical clearance as specified in Section 232 of the National Electrical Safety Code, 1973; *Provided, however,* That in no event shall any high-voltage powerline be installed less than 15 feet above ground, walkways, or working areas.

§ 77.805–1 Booms and masts; minimum distance from high-voltage powerlines.

The booms and masts of equipment, except insulated aerial buckets when used in repair of energized powerlines, operated on the surface of any coal mine shall not be operated within 10 feet of an energized overhead high-voltage powerline. Where the voltage of overhead powerlines is 69,000 volts or more, the minimum distance from the boom or mast shall be as follows:

Nominal powerline voltage (in 1,000 v):	*Minimum distance (feet)*
69 to 114	12
115 to 229	15
230 to 344	20
345 to 499	25
500 or more	35

§ 77.805–2 Movement of equipment; minimum distance from high-voltage powerlines.

When any part of any equipment operated on the surface of any coal mine is required to pass under or by an energized high-voltage powerline and the clearance between such equipment and powerline is less than that specified in § 77.805–1 for booms and masts, such powerlines shall be deenergized.

§ 77.805–3 Operation of dump trucks under high-voltage powerlines.

(a) When dumping points, shop areas or parking areas for dump trucks are located under high-voltage powerlines, the minimum vertical clearance of such powerlines shall be 5 feet more than the maximum height of the truck bed measured with the truck bed in the extreme raised position.

(b) In cases where dump trucks are operated on haulage roads, the minimum vertical clearance of overhead high-voltage powerlines shall be 5 feet more than the maximum height of the truck bed measured with the truck bed in the extreme raised position unless a grounded conductor in compliance with § 77.520 is installed directly under each phase conductor so that a truck bed will contact the grounded conductor first as the truck bed is raised.

§ 77.805–4 Booms and masts; warning devices.

(a) Except as provided paragraph (b) of this section, self-propelled equipment with booms and masts which can extend higher than 15 feet above ground shall be equipped with an audible and visible warning device that gives a warning when the boom or mast is within the distance specified in § 77.805–1. The distance shall be measured from that point on the equipment which can be moved closest to the powerline by normal operation.

(b) Warning devices are not required for draglines, shovels, wheel excavators and crawler mounted drills which are not operated within 300 feet of high-voltage powerlines, and for line trucks equipped with insulated aerial buckets designed for use in repair of energized powerlines.

§ 77.806 Work on high-voltage powerlines; deenergization and grounding.

(a) Except as provided in paragraphs (b) and (c) of this section, high-voltage powerlines shall be deenergized and grounded before work is performed on or within 4 feet of such powerlines.

(b) Repairs shall be permitted on energized high-voltage powerlines if such repairs are made by a qualified person in accordance with procedures and safeguards set forth in §§ 77.806–2 through 77.806–9, as applicable.

(c) An additional circuit may be connected to an energized high-voltage powerline provided such work is performed from the ground by a person qualified under the provisions of § 77.104. Such qualified person shall wear rubber insulating gloves and shall use an insulated stick. The insulated stick shall be designed for such use and shall be maintained to protect the qualified person from the voltage to which he is exposed. Rubber insulating gloves and insulated sticks shall meet the requirements of §§ 77.806–7 and 77.806–7, as applicable.

§ 77.806–1 Work on high-voltage powerlines.

(a) No high-voltage powerline shall be regarded as deenergized for the purpose of performing work on it, until it has been determined by a qualified person that such powerline has been deenergized and grounded. The qualified person shall by visual observation:

(1) Determine that the disconnecting devices on the high-voltage powerline are in an open position, and

(2) Insure that each ungrounded conductor of the high-voltage powerline upon which work is to be done is properly connected to the system grounding medium. In the case of resistance-grounded or solidly grounded systems, the neutral wire is the system grounding medium. In the case of an ungrounded power system, either the steel armor or conduit enclosing the system conductors or a surface ground field is a system grounding medium.

(b) No work shall be performed on any high-voltage powerline which is supported by any pole or structure which also supports other high-voltage powerlines until:

(1) All high-voltage powerlines supported on the pole or structure are deenergized and ground in accordance with the provisions of paragraph (a) of this section; or

(2) The provisions of §§ 77.806–2 through 77.806–9 have been complied with, with respect to all energized powerlines which are supported on the pole or structure.

§ 77.806–2 Repairs on energized high-voltage powerlines.

Before energized high-voltage powerlines are repaired:

(a) The operator shall determine that:

(1) Such repairs cannot be scheduled during a period when the power circuit could be properly deenergized and grounded;

(2) Such repairs will be performed on power circuits with a phase-to-phase nominal voltage no greater than 15,000 volts;

(3) Such repairs on circuits with a phase-to-phase nominal voltage of 5,000 volts or more will be performed only with the use of live line tools;

(4) Weather conditions will not interfere with such repairs or expose those persons assigned to such work to danger; and

(b) The operator shall designate a person qualified under the provisions § 77.104 as the person responsible for carrying out such repairs. The operator shall require that the qualified person file with the operator:

(1) A general description of the nature and location of the damage or defect to be repaired;

(2) The general plan to be followed in making such repairs;

(3) A statement that a briefing of all qualified persons assigned to make such repairs was conducted informing them of the general plan, their individual assignments, and the dangers inherent in such assignments;

(4) A list of the proper protective equipment and clothing that will be provided; and

(5) Such other information as the qualified person designated by the operator feels necessary to describe properly the means or methods to be employed in such repairs.

(c) The operator shall submit a repair plan to and obtain approval from the District Manager for work performed on powerlines energized at more than 15,000 volts. Repair of such powerlines shall be performed in accordance with the approved plan.

§ 77.806–3 Repairs on energized high-voltage powerlines; reporting.

Any operator designating and assigning qualified persons to perform repairs on energized high-voltage powerlines under provisions of § 77.806–2 shall maintain a record of such repairs. Such record shall contain the time, date, location, general nature of the repairs, and a copy of the information filed with the operator by the qualified person designated as responsible for performing such repairs.

§ 77.806–4 Simultaneous repairs.

When two or more qualified persons are repairing energized high-voltage powerlines simultaneously, and any one of them is within reach of another, such persons shall not be allowed to work on different phases or on equipment with different potentials.

§ 77.806–5 Protective equipment; installation and use.

(a) Before repair work on energized high-voltage powerlines is begun, rubber protective equipment shall be used to cover all bare conductors, ground wires, guys, telephone lines, and other attachments in proximity to the area of planned repairs. Such protective equipment shall be installed from a safe position below the conductors or other apparatus being covered.

(b) All qualified persons repairing energized high-voltage powerlines shall wear protective rubber lineman's gloves, sleeves, and climber guards if climbers are worn. Protective rubber gloves shall not be worn wrong side out or without protective leather gloves. Protective equipment worn by a person assigned to perform repairs on energized high-voltage powerlines shall be worn continuously from the time he leaves the ground until he returns to the ground.

§ 77.806–6 Protective equipment; design, manufacture and testing.

(a) All rubber protective equipment required by §§ 77.806(c), 77.806–5, and 77.807 shall have a minimum electrical rating of 20,000 volts a.c. and shall be designed, manufactured and tested in accordance with the provisions of the American National Standards Institute standards or the American Society for Testing and Materials standards as follows:

Item	ANSI standard	ASTM standard
Rubber insulating:		
Gloves	J6.6–1971	D120–70
Blankets	J6.4–1971	D1048–70
Hoods	J6.2–1971	D1048–70
Line hose	J6.1–1971	D1050–70
Sleeves	J6.5–1971	D1051–70

(1) Rubber protective equipment shall be tested in accordance with the following schedules:

(i) Rubber gloves; once each month.

(ii) Rubber sleeves; once every 3 months.

(iii) Rubber blanket; once every 6 months.

(iv) Rubber hoods and line hose; once a year.

(b) Live line tool poles required to be used by §§ 77.806(c) and 77.807 shall have a manufacturer's certification that such poles will withstand the following minimum tests:

(1) 100,000 volts per foot of length for 5 minutes when the tool is made of fiberglass, or

(2) 75,000 volts per foot of length for 3 minutes when the tool is made of wood.

(c) Where insulated aerial buckets are used in the repair of energized high-voltage powerlines, they shall be subjected to a leakage current test before use each day, each time during the day when a higher voltage is going to be worked and when changed conditions indicate a need for additional tests. Such test shall consist of placing the bucket in contact with an energized source equal to the voltage to be worked for a minimum time of three minutes. The leakage current shall not exceed 1 microampere per kilovolt of nominal line-to-line voltage.

§ 77.806–7 Protective equipment; inspection and storage.

(a) Each qualified person shall visually inspect the protective equipment provided him in accordance with §§ 77.806(c), 77.806–5, and 77.807 before using such equipment, and any protective equipment containing any defect or damage shall not be used.

(b) Rubber insulating gloves shall not be stored wrong side out. Rubber insulating blankets shall be rolled when not in use. Rubber insulating line hose and hoods shall be stored in their natural position and shape.

§ 77.806–8 Use of grounded messenger wires; ungrounded systems.

Grounded messenger wires used to suspend cables supplied power from an ungrounded high-voltage system may be used to ground the power conductors for the purposes of performing work on the power conductors.

§ 77.806–9 Metal measuring tapes and ropes.

Measuring tapes and measuring ropes containing metal shall not be used when working on or near energized parts.

§ 77.807 Operating disconnecting devices.

All disconnecting devices designed to be operated by means of an insulated stick, fuse tong or puller shall be operated only by a person qualified under the provision of §§ 77.103 or 77.104. Such qualified person shall wear rubber insulating gloves and shall use an insulated stick, fuse tong or puller which shall be maintained to protect such person from the voltage to which he is exposed. Rubber insulating gloves and insulated sticks, fuse tongs and pullers shall meet the requirements of §§ 77.806–6 and 77.806–7, as applicable.

§ 77.807–1 Platforms at disconnecting devices.

Platforms insulated for the phase-to-phase voltage of the system, shall be installed at all overhead disconnecting devices that are operated from the ground by means of mechanical linkage. However, metal plates or grids on which a person normally would stand which are electrically bonded to the metal operating handles of the power switches may be used.

§ 77.808 Visual disconnecting devices.

Disconnecting devices shall be installed at the beginning of each branch line in high-voltage circuits and at the entrance to all high-voltage installations and they shall be equipped or designed in such a manner that it can be determined by visual observation that the circuit is deenergized when such devices are open.

§ 77.809 Movement of high-voltage power substations, transformers and switchgear.

High-voltage portable substations, transformers and switchgear shall be deenergized before they are moved from one location to another and shall be examined by a qualified person to assure safe operating condition prior to reenergization.

§ 77.810 Incorporation by reference.

In accordance with 5 U.S.C. 552(a)(1), the publications to which references are made in this subpart are hereby incorporated by reference and made a part hereof. The incorporated publications are available for examination at each Coal Mine Health and Safety District and Subdistrict Office of MESA. The National Electrical Codes are also available from the National Fire Protection Association, 470 Atlantic Ave., Boston, Mass. 02210. AIEE publications are also available from the American Institute of Electrical Engineers, the National Electrical Safety Code, IEEE and AIEE, publications are also available from the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th St., New York, N.Y. 10017. IPCEA publications are also available from the Insulated Power Cables Engineers Association, 192 Washington St., Belmont, Mass. 02178. ASTM publications are also available from the American Society for Testing and Materials, 1916 Race St., Philadelphia, Pa. 19103. ANSI publications are also available from American National Standards Institute, Inc., 1430 Broadway, New York, N.Y. 10018. Incorporation by reference provisions approved by the Director of the Federal Register on (date to be inserted prior to final rulemaking).

Subpart J—Low- and Medium-Voltage Alternating Current Circuits

§ 77.900 Protection of low- and medium-voltage alternating current circuits.

All low- and medium-voltage alternating current circuits, except those circuits protected under §§ 77.601, 77.602, and 77.1800, shall be protected as follows:

(a) Resistance-grounded and solidly grounded low- and medium-voltage circuits shall be protected against short-circuit, overload and ground-fault by circuit breakers equipped with devices to provide such protection, or by fuses of the correct type and capacity.

(b) Ungrounded low- and medium-voltage circuits shall be protected against short-circuit and overload by circuit breakers equipped with devices to provide such protection, or by fuses of the correct type and capacity. Circuits supplied power from an ungrounded low- and medium-voltage system shall be protected against ground-fault by a circuit breaker equipped with a device to provide such protection, or a ground-fault indicator shall be installed that will give visual warning at an attended location upon occurrence of a ground-fault on any circuit supplied power from such system. A ground-fault condition shall not be allowed to exist on an energized circuit for longer than 24 hours.

§ 77.900–1 Short-circuit and overload protection; requirements.

(a) Where circuit breakers or fuses provide short-circuit and overload protection for low- or medium-voltage circuit breakers or fuses shall conform to the requirements for protection of circuits as specified in the National Electrical Code as follows:

(1) For circuits installed before [the effective date of this section]—the National Electrical Code, 1968, 1971, or 1975.

(2) For circuits installed after [the effective date of this section]—the National Electrical Code, 1975.

§ 77.900–2 Ground-fault protection: requirements.

(a) Where a circuit breaker provides ground-fault protection for a resistance-grounded or a solidly grounded low- or medium-voltage circuit, such circuit breaker shall be equipped with a device which shall be adjusted to trip the circuit breaker when the ground-fault current in any ungrounded power conductor exceeds 50 percent of the lowest value of bolted ground-fault current at any point in the circuit.

(b) Where a circuit breaker provides ground-fault protection for an ungrounded low- or medium-voltage circuit, such circuit breaker shall be equipped with a device which shall be adjusted to trip the circuit breaker when the line-to-ground voltage on any power conductor decreases to less than 30 percent of the nominal system voltage for a circuit supplied power from a three phase system or 50 percent of the nominal system voltage for a circuit supplied power from a single phase system.

(c) Where fuses provide ground-fault protection for a resistance-grounded or solidly grounded low- or medium-voltage circuit, one fuse shall be installed in each ungrounded power conductor. Each fuse shall have a current rating not exceeding 40 percent of the lowest value of bolted ground-fault current at any point in the circuit.

§ 77.900–3 Ground-fault indicator; requirements.

Where a ground-fault indicator is used to provide ground-fault indication for an ungrounded low- or medium-voltage circuit, it shall be adjusted to give a visual indication when the line-to-ground voltage on any power conductor decreases to less than 30 percent of the nominal system voltage for a circuit supplied power from a three phase system or 50 percent of the nominal system voltage for a circuit supplied power from a single phase system.

§ 77.901 Low- and medium-voltage alternating current systems supplying power to portable or self-propelled equipment; system and enclosure grounding.

(a) *System Grounding.* (1) Low- and medium-voltage systems supplying power to three-phase portable or self-propelled equipment shall contain either a direct or derived neutral which shall be grounded through a suitable grounding resistor to a low-resistance grounding medium at the power source.

(2) Low- and medium-voltage systems supplying power to single-phase portable or self-propelled equipment shall be grounded in accordance with §§ 77.902(a)(4) and (a)(5).

(b) *Enclosure grounding.* (1) A ground wire which meets the requirements of § 77.520 shall originate at the grounded side of the grounding resistor. Such ground wire shall be connected to the metallic frames and enclosures of the power source and shall extend along with the power conductors and serve as the grounding circuit for:

(i) The metallic frames and other metallic enclosures of all portable and self-propelled equipment supplied power from the system, and

(ii) The metallic enclosures of all circuits which are supplied power from the system and extend to portable and self-propelled equipment.

(2) The metallic frames and other metallic enclosures of all single-phase portable or self-propelled equipment and the metallic enclosures of all circuits which extend to single-phase portable and self-propelled equipment shall be grounded in accordance with § 77.902(b).

§ 77.901–1 Grounding resistors; portable and self-propelled equipment.

(a) The grounding resistor required by § 77.901(a)(1) shall be of the proper ohmic value to limit the ground fault current to no more than 25 amperes.

(b) The ground-fault current rating of the grounding resistor required by § 77.901(a)(1) shall meet the "extended time rating" set forth in American Institute of Electrical Engineers, Standard No. 32. Such grounding resistor shall be insulated from ground for a voltage not less than the phase-to-phase voltage of the system in which it is installed.

§ 77.902 Low- and medium-voltage alternating current systems supplying power to stationary equipment; system and enclosure grounding.

(a) *System grounding.* Low- and medium-voltage alternating current systems supplying power to stationary equipment shall be grounded in accordance with the following:

(1) The neutral point of wye connected three-phase four-wire systems in which the neutral is used as a power conductor shall be solidly grounded to a low-resistance grounding medium at the power source.

(2) The midpoint of one phase of 240/120 volt three-phase four-wire systems in which such midpoint is used as a power conductor shall be grounded to a low-resistance grounding medium at the power source.

(3) All other three-phase systems:

(i) Shall be installed and maintained ungrounded, or

(ii) Shall contain a direct or derived neutral which shall be solidly grounded to a low-resistance grounding medium at the power source, or

(iii) Shall contain a direct or derived neutral which shall be grounded through a suitable grounding resistor to a low-resistance grounding medium at the power source.

(4) Single-phase systems shall be grounded when the system can be grounded so that the maximum voltage on the ungrounded conductors does not exceed 150 volts.

(5) All other single-phase systems:

(i) Shall be installed and maintained ungrounded, or

(ii) Shall be solidly grounded to a low-resistance grounding medium at the power source, or

(iii) Shall contain a direct or derived neutral which shall be grounded through a suitable grounding resistor to a low-resistance grounding medium at the power source.

(b) *Enclosure grounding.* Metallic frames and other metallic enclosures of stationary electric equipment and circuits supplied power from low- and medium-voltage alternating current systems shall be grounded in accordance with the following:

(1) *Resistance-grounded systems.* A grounding conductor which meets the requirements of § 77.521 shall originate at the grounded side of the grounding resistor. Such grounding conductor shall be connected to the metallic frames and enclosures of the power source and shall extend along with the power conductors and serve as the grounding circuit for the metallic frames and other metallic enclosures of all stationary electric equipment and circuits supplied power from the system. The grounding conductor shall also be connected to a low-resistance grounding medium at the service equipment for buildings and other stationary installations.

(2) *Solidly grounded systems.* Except as provided in paragraph (b)(2)(i) of this section, a grounding conductor which meets the requirements of § 77.521 shall originate at the grounded point of the power source. Such grounding conductor shall be connected to the metallic frames and enclosures of the power source and shall extend along with the power conductors and serve as the grounding circuit for the metallic frames and other metallic enclosures of all stationary electric equipment and circuits supplied power from the system. The grounding conductor shall also be connected to a low-resistance grounding medium at the service equipment for buildings and other stationary installations.

(i) Metallic frames and other metallic enclosures of service equipment and circuits may be grounded to the grounded power conductor of the system provided the grounded power conductor meets the requirements of § 77.520 and originates at the grounded point of the power source. Such grounded power conductor shall be connected to the metallic frames and enclosures of the power source, and to a low-resistance grounding medium at the power source and to a low-resistance grounding medium at the service equipment for buildings and other stationary installations. In such installations, a grounding conductor which meets the requirements of § 77.521 shall be connected to the grounded service equipment and shall extend along with the power conductors and serve as the grounding circuit for the metallic frames and other metallic enclosures of all stationary equipment and circuits supplied power from such service equipment.

(3) *Ungrounded systems.* A grounding conductor which meets the requirements of § 77.521 shall originate at a low-resistance grounding medium at the power source. Such grounding conductor shall be connected to the metallic frames and enclosures of the power source and shall extend along with the power conductors and serve as the grounding circuit for the metallic frames and other metallic enclosures of all stationary equipment and circuits supplied power from the system. The grounding conductor shall also be connected to a low-resistance grounding medium at the service equipment for buildings and other stationary installations.

§ 77.902–1 Grounding resistors; stationary equipment.

The ground-fault current rating of the grounding resistor for a low- and medium-voltage system supplying power to stationary equipment shall meet the "ten-minute rating" set forth in American Institute of Electrical Engineers (AIEE) Standard No. 32. Such grounding resistor shall be insulated from ground for a voltage not less than the phase-to-phase voltage of the system in which it is installed.

§ 77.903 Connection of single-phase loads.

Single-phase loads shall be connected phase-to-phase in resistance-grounded systems.

§ 77.904 Incorporation by reference.

In accordance with 5 U.S.C. 552(a)(1), the publications to which references are made in this subpart are hereby incorporated by reference. The incorporated publications are available for examination at each Coal Mine Health and Safety District and Subdistrict Office of MESA. The National Electrical Codes are also available from the National Fire Protection Association, 470 Atlantic Ave., Boston, Mass. 02210. The AIEE publication is also available from the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th St., New York, N.Y. 10017. Incorporation by reference provisions approved by the Director of the Federal Register on (date to be inserted prior to final rulemaking).

Subpart K—Ground Control

§ 77.1000 Highwalls, pits and spoil banks; plan.

Each operator of a surface coal mine shall establish and follow a ground control plan, approved in accordance with the provisions of §§ 77.1000–1 through 77.1000–6, for the safe control of all highwalls, pits and spoil banks developed at such mine.

§ 77.1000–1 Filing of ground control plan.

Ground control plans shall be filed with the District Manager of the Coal Mine Health and Safety District in which the mine is located.

§ 77.1000–2 Mines with plans on file on the effective date of this section.

(a) Ground control plans on file with the District Manager for mines operating on the effective date of this section shall be considered approved until such plans are reviewed and approved or disapproved in accordance with the provisions of this section.

(b) Mines operating on the effective date of this section that have ground control plans on file with the District Manager shall have their plans reviewed within one year from the effective date of this section, and the operator shall be advised in writing of the approval or disapproval of his ground control plan.

§ 77.1000–3 Mines without plans on file on the effective date of this section.

(a) Operators of new mines and mines without approved ground control plans shall submit a ground control plan to the District Manager prior to the commencement of excavation.

(b) The operator shall be advised in writing of the approval or disapproval of his ground control plan.

§ 77.1000–4 Revision in ground control plans prior to approval.

If the District Manager determines that revisions are required before a ground control plan can be approved, the revisions required shall be specified, the operator shall be afforded an opportunity to discuss the revisions, and the operator shall be given not less than 30 days to submit revisions.

§ 77.1000–5 Modification of approved ground control plans.

Each operator, prior to initiating a modification of any approved ground control plan, shall file such modification with the District Manager. The operator shall be notified in writing of the approval or disapproval of his modification. If the District Manager determines that revisions are required before the modification can be approved, the revisions required shall be specified and the operator shall be afforded an opportunity to discuss the revisions.

§ 77.1000–6 Information required in ground control plans.

(a) Ground control plans shall contain the following information:

(1) Name and address of the operator.

(2) Name, identification number and address of the mine.

(3) Geographic location of all pits.

(4) List of equipment used for moving overburden and loading coal.

(5) Description of the mining sequence.

(6) General characteristics of the strata.

(7) Average height and angle of the highwall.

(8) Approximate width and location of highwall benches.

(9) Approximate width of pit.

(10) Minimum and maximum slope of ground to be stripped.

(11) Angle and diameter of boreholes.

(12) Description of blasting methods.

(13) Method of trimming and scaling the highwall.

(14) Method of preventing material from rolling into the pit including the distance material will be stripped from the highwall.

(15) Method of controlling or draining water.

§ 77.1000–7 Criteria for approval of ground control plans.

(a) Each ground control plan shall be considered on its own merits in providing protection to miners. District Managers shall be guided by the following criteria in approving ground control plans:

(1) All loose hazardous material should be stripped for a safe distance from the top edge of pits, highwalls and benches.

(2) Hazardous highwall areas should be scaled by a safe means before any other work is performed in the hazardous area.

(3) Highwall benches should be required if necessary to assure that scaling and trimming can be accomplished with available equipment.

(4) The method of mining should minimize the exposure time of unprotected persons near the highwall.

(5) The width and height of benches should be consistent with the type of equipment to be used and the operation to be performed.

(6) Spoil material should be sloped to the angle of repose or other measures taken to prevent the material from rolling into active work areas.

(7) Drilling and blasting methods should be used which will maximize highwall stability.

§ 77.1001 Ground control inspection and maintenance; general.

Highwalls, banks, benches and terrain sloping into the working areas shall be examined by a certified person within two hours before each operating shift and after every rain, freeze or thaw before men work in such areas; and such examinations shall be made and recorded in accordance with § 77.1713.

§ 77.1002 Highwalls; men working.

(a) Persons, other than those necessary to correct unsafe conditions, shall not work near or under dangerous highwalls or banks.

(b) Except as provided in paragraph (c) of this section, persons shall not work between equipment and the highwall or spoil bank where the equipment may hinder escape from falls or slides.

(c) Special safety precautions shall be taken when persons are required to perform repair work between immobilized equipment and the highwall or spoil bank and such equipment may hinder escape from falls or slides.

§ 77.1003 Drilling; equipment, general.

(a) Drilling equipment that is to be used during a shift shall be inspected each shift by a competent person. Equipment defects affecting safety shall be reported.

(b) Drilling equipment defects affecting safety shall be corrected before the equipment is used.

§ 77.1004 Relocation of drills; safeguards.

(a) When a drill is being moved from one drilling area to another, drill steel, tools, and other equipment shall be secured and the mast placed in a safe position.

(b) When a drill helper is used, his location shall be made known to the operator at all times when the drill is being moved.

§ 77.1005 Drill; operation.

(a) While in operation, drills shall be attended at all times.

(b) Persons shall not drill from positions that hinder their access to the control levers, or from insecure footing or staging, or from atop equipment not designed for this purpose.

(c) Persons shall not be on a mast while the drill bit is in operation unless a safe platform is provided and safety belts are used.

(d) Drill crews and others shall stay clear of augers or drill stems that are in motion. Persons shall not pass under or step over a moving stem or auger.

(e) In the event of a power failure, drill controls shall be placed in the neutral position until power is restored.

(f) When churn drills or vertical rotary drills are used, drillers shall not be permitted to work under suspended tools, and when collaring holes, inspecting, or during any operation in which tools are removed from the hole, all tools shall be lowered to the ground or platform.

(g) Where horizontal holes are drilled in the overburden, a careful inspection of the face of the highway shall be made before drilling operations begin, and all loose hazardous material shall be removed before other work is done, or the area shall be vacated and posted.

§ 77.1006 Collaring holes.

(a) Starter steels shall be used when collaring holes with hand-held drills.

(b) Persons shall not hold the drill steel while collaring holes, or rest their hands on the chuck or centralizer while drilling.

§ 77.1007 Drill holes; guarding.

Drill holes large enough to constitute a hazard shall be covered or guarded.

§ 77.1008 Jackhammers; operation: safeguards.

Persons operating or working near jackhammers or jackleg drills, or other drilling machines shall position themselves so that they will not be struck or lose their balance if the drill steel breaks or sticks.

§ 77.1009 Air drills; safeguards.

Air shall be turned off and bled from the air hoses before hand-held air drills are moved from one working area to another.

9. Subparts M, N, O, P, and Q are revised as follows:

Subpart M—Maps

§ 77.1200 Mine map.

The operator shall maintain an accurate and up-to-date map of the mine, on a scale of not less than 100 or more than 500 feet to the inch, at or near the mine, in an area chosen by the mine operator, with a duplicate copy on file at a separate and distinct location, to minimize the danger of destruction by fire or other hazard. The map shall show:

(a) Name and address of the mine;

(b) The property or boundary lines of the active areas of the mine;

(c) Contour lines passing through whole number elevations of the coalbed being mined. The spacing of such lines shall not exceed 25-foot elevation levels, except that a broader spacing of contour lines may be approved by the District Manager for steeply pitching coalbeds. Contour lines may be placed on overlays or tracings attached to mine maps;

(d) The general elevation of the coalbed or coalbeds being mined, and the general elevation of the surface;

(e) Producing or abandoned oil and gas wells located on the mine property

and the location of all oil and gas pipelines on the mine property;

(f) The location and elevation of any body of water dammed or held back in any portion of the mine; provided, however, such bodies of water may be shown on overlays or tracings attached to the mine maps;

(g) All prospect drill holes that penetrate the coalbed or coalbeds being mined on the mine property;

(h) All auger and strip mined areas of the coalbed or coalbeds being mined on the mine property together with the line of maxium depth of holes drilled during auger mining operations;

(i) All worked out and abandoned areas;

(j) The location of overhead powerlines, railroad tracks and public highways leading to the mine, and mine buildings of a permanent nature with identifying names shown;

(k) Underground mine workings, active or abandoned, in underlying, overlying, or in the same coalbed(s) and within 1,000 feet in any direction of the active areas of the mine; provided, however, such workings may be shown on overlays or tracings attached to the mine map;

(l) The location and description of at least two permanent base line points, and the location and description of at least two permanent elevation bench marks used in connection with establishing or referencing mine elevation surveys; and

(m) The scale of the map.

§ 77.1200–1 Temporary notations, revisions and supplements.

(a) Mine maps shall be revised and supplemented at intervals of not more than 6 months on the basis of a survey made or certified as required by § 77.1201.

(b) Mine maps shall be kept up-to-date by temporary notations. Up-to-date is interpreted to mean at least once a month. Temporary notations shall include:

(1) Areas where overburden has been removed; and

(2) Areas where coal has been removed, either by surface mining or augering.

§ 77.1201 Certification of mine map.

The mine map shall be made or certified by an engineer or surveyor registered by any State.

§ 77.1202 Availability of mine map.

The mine map maintained in accordance with the provisions of § 77.1200 shall be available for inspection by the Secretary or his authorized representative.

§ 77.1203 Mine closure; filing of map with Secretary or his representative.

Whenever an operator permanently closes or abandons a coal mine, he shall promptly notify the Coal Mine Health and Safety District or Subdistrict Office for the area in which the mine is located of such closure. Within 60 days after the permanent closure or abandonment of a mine, the operator shall file with the Secretary or his authorized representative, a copy of the mine map revised and supplemented to the date of the closure. Such copy of the mine map shall be certified by an engineer or surveyor registered by any State.

Subpart N—Explosives and Blasting

§ 77.1300 Explosive material; general.

Explosives, blasting agents, detonators, or any other related blasting device or material shall not be stored, transported, carried, handled, charged, fired, destroyed or otherwise used, employed or disposed of by any person at a coal mine except in accordance with the storage provisions of Bureau of Alcohol, Tobacco and Firearms regulations in 27 CFR Subpart J of Part 181, and as prescribed in this subpart.

§ 77.1301 Magazine; location.

(a) In addition to the magazine location requirements of Bureau of Alcohol, Tobacco and Firearms regulations in 27 CFR Subpart J of Part 181 the magazine shall be:

(1) Located outside the blasting area, and

(2) Located at distances from any office, shop, tipple or plant, wash and changehouse, and any stationary equipment, structure or facility used in the mine operation including fans, fan housings, mine openings, dams and electrical transformers or substation installations as specified for "inhabited buildings" in the "American Table of Distances for Storage of Explosives" as revised and approved by the Institute of Makers of Explosives (IME)—November 5, 1971, and published in the Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials 1973, NFPA No. 495, pages 59 through 62.

§ 77.1302 Magazine; storage.

In addition to storage provisions of Bureau of Alcohol, Tobacco and Firearms regulations in 27 CFR Subpart J of Part 181, the following shall apply:

(a) Ammonium nitrate-fuel oil blasting agents shall be separated from explosives or detonating cord stored in the same magazine and in such a manner that oil does not contaminate the explosives or detonating cord.

(b) The magazines shall be detached structures located at least 50 feet away from that point or area directly beneath powerlines.

(c) The magazine area shall be posted with appropriate danger signs which are so located that a bullet passing in the direction of the sign will not strike the magazine.

(d) The magazines shall be unheated unless heating can be provided in a manner that does not create a fire or explosion hazard.

(e) Containers of explosives or blasting agents shall be stacked in a stable manner, but not more than 8 feet high.

§ 77.1303 Persons permitted to use explosives.

(a) Each blasting operation shall be under the direct supervision of a person trained and experienced in the handling of explosives and blasting agents.

(b) Trainees shall work under the direct supervision of and in the immediate presence of a trained and experienced person.

§ 77.1304 Transport of explosives or blasting agents.

(a) Vehicles used to transport explosives shall have substantially constructed bodies, no sparking metal exposed in the cargo space, and shall be equipped with suitable sides and tail gates. Explosives shall not be piled higher than the side or end of the cargo space.

(b) Vehicles used to transport explosives or blasting agents shall be maintained in good condition and shall be operated at a safe speed and in accordance with safe operating practices.

(c) Vehicles containing explosives or blasting agents shall be posted with appropriate warning signs.

(d) Other materials or supplies shall not be placed on or in the cargo space of a vehicle containing explosives, except for properly secured nonsparking equipment used expressly in the handling of such explosives.

(e) Explosives or blasting agents shall be transported in separate vehicles from detonators unless in closed containers separated by 4 inches of substantially fastened hardwood or equivalent partition.

(f) Explosives or blasting agents shall be transported without undue delay and over routes and at times that expose a minimum number of persons.

(g) Only persons necessary for safe transport shall ride in vehicles containing explosives or blasting agents.

(h) Vehicles shall be attended while loaded with explosives or blasting agents except in areas where charging is in progress.

(i) When vehicles containing explosives or blasting agents are parked, the brakes shall be set, the motive power shut off unless utilized to discharge bulk blasting agents. The vehicle shall be provided with chocks and the vehicle blocked securely against rolling when parked on a grade.

(j) Vehicles containing explosives or blasting agents shall not be taken to a repair garage or shop for any purpose.

(k) Vehicles used to transport blasting agents to the blasting site shall have substantially constructed bodies with no zinc or copper exposed in the cargo space. If an end screw is used to discharge the blasting agents from the vehicle, the conveyor shall be constructed to prevent development of excessive internal pressure and frictional heat in the blasting agent.

(l) Over-the-road, drop-off vans containing blasting agents shall be effectively ventilated with at least two screened ventilation openings near the

floor and the ceiling when serving as a storage facility, but these ventilation openings shall be closed off securely during transport of the blasting agent.

(m) Caution shall be exercised in the movement of the vehicle in the blasting area to avoid driving the vehicle over or dragging hoses over firing lines, detonator wires, explosives, blasting agents or detonators.

§ 77.1305 Priming of explosives or blasting agents.

(a) Primers shall be made up only at the time of charging and as close to the blasting area as conditions allow.

(b) Primers: (1) Containing a detonator shall be prepared with the detonator contained securely and completely within the explosive charge or within a suitable tunnel or cap well.

(2) Using detonating cord shall be prepared with the detonating cord threated through, attached securely to, or otherwise in intimate contact with the explosive charge.

(c) Adequate priming shall be employed to minimize misfires, toxic fumes, and poor performance.

(d) Only nonsparking implements shall be used to punch holes in an explosive cartridge.

(e) Tamping poles shall be of wood or other material acceptable to MESA. Couplers of tamping poles shall be of nonsparking materials.

(f) Tamping shall not be done directly on a primer.

(g) Charging of boreholes shall be suspended and persons withdrawn from the blasting area to a safe location upon the approach and progress of an electrical storm.

§ 77.1306 Firing of explosive charges.

(a) Safety fuse and blasting cap initiation shall not be used.

(b) Electrical blasts shall be fired only with instruments designed specifically for initiating electrical detonators, and having adequate capacity for the number of electrical detonators, the resistance of the blasting circuit and the type of blasting circuit used.

(c) A person trained and experienced in the handling of explosives and blasting agents and who is authorized by the operator to fire the shots shall control the electrical firing device.

(d) Electric blasting caps of different manufacturers shall not be used in the same circuit.

(e) Blasting circuits and electric blasting caps which are capable of being initiated by conventional power sources shall be protected from sources of extraneous electricity.

(f) When blasting electrically, a basting galvanometer, or other instruments that are specifically designed for testing blasting circuits, shall be used to test:

(1) Resistance of individual series or the resistance of multiple balanced series to be connected in parallel prior to their connection to the blasting line,

(2) Continuity of blasting lines prior to the connection of electric blasting cap series, and

(3) Total blasting circuit resistance prior to connection to the power source.

(g) Except when being tested for continuity or resistance:

(1) Electric blasting caps shall be kept shunted until being connected to the blasting line or wired into a blasting circuit,

(2) Wired rounds shall be kept shunted until being connected to the blasting line, and

(3) Blasting lines shall be kept shunted until immediately before blasting.

(h) Blasting lines shall be properly insulated and kept in good repair.

(i) Electric blasting shall be prohibited in the vicinity of operating radio frequency (RF) transmitters except within clearances as published in the Institute of Makers of Explosive (IME), Publication No. 20, March 1971, "Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Electric Blasting Caps."

(j) Appropriate warning signs shall be posted on all roads within 350 feet of charging operations, when blasting electrically, prohibiting the use of mobile radio transmitters except in accordance with paragraph (i) of this section.

§ 77.1307 Detonating cord.

(a) Delay connectors shall be treated and handled with the same safety precautions as detonators.

(b) Detonating cord shall not be used if it has been kinked, bent sharply or otherwise damaged.

(c) The line of detonating cord extending out of a borehole shall be cut from the supply spool after the primer is correctly positioned and the line secured.

(d) All detonating cord knots shall be tight and all connections shall be kept at right angles to the trunk lines.

§ 77.1308 Blasting area.

(a) Substantial non-conductive closed containers shall be used to carry explosives other than blasting agents to the blasting area.

(b) Explosives or blasting agents shall be kept separated from detonators until charging is started.

(c) Smoking and open flame shall not be permitted within 50 feet of the area in which explosives or blasting agents are being handled and used.

(d) Unused explosives, blasting agents and detonators shall be moved to a safe location as soon as practical after charging operations are completed.

(e) Boreholes shall be stemmed immediately after charging. Shots shall be fired as soon as practical after stemming has been completed.

(f) Areas in which charged holes are being finally prepared for firing shall be guarded, or barricaded and posted, or flagged against unauthorized entry.

(g) Work activities may be conducted within the blasting area containing charged holes, *Provided*, That:

(1) Detonating cord shall be protected from physical damage,

(2) Refueling operations shall not be conducted within a horizontal distance of 100 feet of a charged hole,

(3) Burning, cutting or welding shall not be conducted within a horizontal distance of 100 feet of a charged hole unless such work is done in a fire resistant enclosure,

(4) Drilling operations shall not be conducted within a horizontal distance of 25 feet of a charged hole, and

(5) Energized electric equipment and energized power distribution circuits including trailing cables and feeder cables shall not be within a horizontal distance of 50 feet of a charged hole.

(h) Ample warning shall be given before blasts are fired. All persons shall be removed from the blasting area.

(i) The firing of blasts shall be conducting during daylight hours, except in shafts and slopes driven to depths where no flying material can reach the surface.

(j) Blasting areas shall not be reentered after firing until dangerous concentrations of smoke, dust and fumes have been reduced to safe limits.

(k) Special precautions shall be taken when blasting in close proximity to underground operations, and no blasting shall be done that would be hazardous to persons working underground.

§ 77.1309 Misfires and damaged explosives or blasting agents.

(a) Damaged or deteriorated explosives or blasting agents shall be destroyed in a safe manner under the instructions of the explosives or blasting agents manufacturer or his designated agent.

(b) Misfires shall be reported to the proper supervisor and shall be disposed of safely before any other work is performed in that blasting area.

(c) No person shall return to a misfired hole for at least 15 minutes.

(d) If explosives or blasting agents are suspected of burning in a hole, all persons in the blasting area shall move to a safe location and no person shall return to the hole for at least one hour.

(e) Blasted areas shall be examined for undetonated explosives or blasting agents after each blast and undetonated explosives or blasting agents found shall be disposed of in accordance with paragraph (a) of this section.

(f) Holes shall be not be drilled where there is danger of intersecting a charged or misfired hole.

§ 77.1310 Blasting agents: special provisions.

Ammonium nitrate and the components used for the sensitizing thereof shall be stored, mixed, transported and used in accordance with the recommendations in Bureau of Mines Information Circular 8179, "Safety Recommendations for Sensitized Ammonium Nitrate Blasting Agents, 1963."

§ 77.1311 Incorporation by reference.

In accordance with 5 U.S.C. 552(a)(1), the publications to which references are made in Subpart A of this part and in this subpart are hereby incorporated by reference and made a part hereof. The incorporated publications are available for examination at each Coal Mine Health and Safety District and Subdistrict Office of MESA. Bureau of Alcohol,

Tobacco and Firearms regulations and Department of Transportation regulations are available from the U.S. Government Printing Office, Washington, D.C. 20402. The Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials 1973, NFPA No. 495 is available from the National Fire Protection Association, 470 Atlantic Ave., Boston, Mass. 02210. IME Publication No. 20, March 1971 is available from the Institute of Makers of Explosives, 420 Lexington Ave., New York, N.Y. 10017. Bureau of Mines Information Circular 8179 is available from the Assistant Administrator—Technical Support, MESA, 4015 Wilson Blvd., Arlington, Va. 22203. Incorporation by reference provisions approved by the Director of the Federal Register on (date to be inserted prior to final rulemaking).

Subpart O—Hoisting, Elevators, and Manlifts

§ 77.1400 Hoists and other hoisting devices.

The standards set forth in §§ 77.1400 through 77.1405–1, apply to hoists and other hoisting devices, together with their appurtenances, used to transport persons.

§ 77.1401 Automatic controls and brakes.

Hoists and other hoisting devices shall be equipped with overspeed controls, overtravel controls, automatic stop controls and brakes. Such controls and brakes shall be protected from the weather to prevent malfunction and shall perform as prescribed in §§ 77.1401–1 through 77.1401–6.

§ 77.1401–1 Overspeed controls.

Overspeed controls on hoists and other hoisting devices shall be directly driven from the hoist drum or drum shaft and, when activated, shall interrupt the power, set the hoist drum brakes, and bring the conveyance to a safe stop. Overspeed activation for hoists and other hoisting devices shall be at a setting not to exceed 115 percent of the rated safe man hoisting speed. Deceleration for hoists and other hoisting devices shall not be greater than 6 feet per second per second.

§ 77.1401–2 Overtravel controls.

Overtravel controls shall be provided on all hoists and other hoisting devices to automatically prevent overtravel of the conveyance. These controls shall be driven from the hoist drum or drum shaft, or activated by the conveyance travel to bring the conveyance to a safe stop.

§ 77.1401–3 Automatic stop controls.

Hoists and other hoisting devices shall be equipped with controls which will cause automatic application of the brakes in case of operator or power failure. A manual override of the controls shall be provided to permit lowering the conveyance by means of the brakes in case of emergency.

§ 77.1401–4 Brakes.

Hoists and other hoisting devices shall be equipped with at least two independent brakes, one of which shall be on the drum. Each brake shall be capable of safely stopping a fully loaded conveyance traveling at the maximum allowable hoisting speed and holding the fully loaded conveyance at any point. These two brakes shall be operable at all times. The mechanism that operates the brakes shall be guarded to prevent material or tools from accidentally fouling or jamming the brake system. These two brakes shall be arranged so that the failure of one brake will not interfere with proper operation of the other brake. Persons shall not be lowered by the brakes alone, except as provided in § 77.1401–3.

§ 77.1401–5 Indicators.

An accurate and reliable indicator of the position of the conveyance shall be provided except where the conveyance is visible at all times to the operator. The indicator shall be driven from the hoist drum or drum shaft by a chain, gear or other direct drive and show the position of the conveyance at all times. This indicator shall be placed so that it is in clear view of the operator.

§ 77.1402 Rated capacity.

Loads transported by hoists and other hoisting devices shall not exceed rated capacities of the hoist, conveyance, rope, rope fastenings used, and the static load safety factors of the ropes as prescribed in § 77.1402–1(b).

§ 77.1402–1 Wire ropes and wire rope attachments.

(a) American National Standards Institute "Specifications for the Use of Wire Ropes for Mines," M11.1–1960, shall be used as a guide in the use, selection, installation, and maintenance of wire ropes used for hoisting.

(b) The following static load safety factors shall be used for selecting ropes to be used on hoists and for determining when such ropes shall be removed from hoists:

Length of rope in shaft (feet)	Minimum factor of safety (new rope)	Minimum factor of safety (remove)
500 or less	8	6.4
501 to 1,000	7	5.8
1,001 to 2,000	6	5.0
2,001 to 3,000	5	4.3
3,001 or more	4	3.6

(c) Wire rope shall be removed when inspection shows:

(1) Six randomly distributed broken wires in one rope lay or three broken wires in one standard in one rope lay. Snagged, nicked or severely bent wires shall be counted as broken wires; or

(2) Abrasion, scrubbing or peening causing loss of more than ⅓ the original diameter of the outside individual wires; or

(3) Evidence of rope deterioration from corrosion; or

(4) Kinking, crushing or other damage that results in distortion of the rope structure; or

(5) Reduction in nominal rope diameter determined as follows:

(i) 1/64 inch for rope diameters up to and including 5/16 inch;

(ii) 1/32 inch for rope diameters 3/8 inch to 1/2 inch inclusive;

(iii) 3/64 inch for rope diameters 9/16 inch to 3/4 inch inclusive;

(iv) 1/16 inch for rope diameters 7/8 inch to 1 1/8 inches inclusive;

(v) 3/32 inch for rope diameters 1 1/4 inches to 1 1/2 inches inclusive;

(vi) Rope diameters over 1 1/2 inches. as recommended by the wire rope manufacturer.

(d) Wire rope attachments shall be replaced when inspection shows:

(1) Improper installation of attachment; or

(2) Cracked, deformed, excessively worn, or loosened attachments; or

(3) Wire rope slippage at attachment; or

(4) More than one broken wire at the point of attachment of a speiter filled or swaged attachment.

§ 77.1402–2 Maximum load; posting.

The operator shall designate and conspicuously post on each conveyance the maximum number of persons permitted to ride on the conveyance.

§ 77.1402–3 Bridle chains or cables.

Each conveyance shall be provided with two bridle chains or cables which are connected securely to the rope at least 3 feet above the socket or at least 3 feet above the last rope clip if a thimble is used and which are securely fastened to the conveyance.

§ 77.1403 Inspection and maintenance.

(a) Hoists and other hoisting devices shall be inspected daily when in use and such inspections shall include, but not be limited to, the following:

(1) A visual inspection of the rope for wear, broken wires, and corrosion, especially at excessive strain points;

(2) An inspection of the rope fastenings for defects;

(3) An inspection of the conveyance for loose, missing, or defective parts;

(4) An inspection of sheaves for broken flanges, defective bearings, rope alignment, and proper lubrication; and

(5) An inspection of the automatic controls, indicator, and brakes.

(b) A report of the daily inspections shall be signed by the person making such inspection and the report shall be signed or countersigned by any of the persons listed in § 77.1713(d).

(c) Prior to each working shift, and before a hoist or other device is returned to service after it has been out of normal service for any reason, and if a change of hoistmen is made for any reason, it shall be operated by the hoistman through one complete cycle of operation before any person is permitted to be transported.

(d) The ropes of hoists and other hoisting devices shall be kept well lubri-

cated from end to end as recommended by the manufacturer.

(e) Persons shall not be permitted to ride on a conveyance with tools or materials other than small hand tools.

§ 77.1404 Qualified hoistman.

Hoists and other hoisting devices shall be under the control of and operated by a qualified hoistman when persons are being transported, except for automatically operated hoists.

§ 77.1405 Communications.

There shall be at least two effective methods approved by the Secretary of signaling between each station and the hoistman, one of which shall be by voice transmission.

§ 77.1405–1 Standard signaling code.

A standard code of hoisting signals shall be adopted, used, and conspicuously posted within easy view of the hoistman and at each station. Movement of a conveyance on a single audible signal shall be prohibited unless preceded by a preliminary signal.

§ 77.1406 Elevators.

Elevators shall comply with the requirements of American National Standards Institute (ANSI) A17.1–1971 with addenda A17.1A–1972, A17.1B–1973 and A17.1C–1974, and shall be inspected in accordance with ANSI A17.2–1973 and § 77.1403.

§ 77.1407 Manlifts.

Manlifts shall be installed, maintained, inspected, and operated in accordance with the requirements of the American Society of Mechanical Engineers (ASME) "Safety Standard for Manlifts" USAS A90.1–1969 and addenda ANSI A90.1A–1972.

§ 77.1408 Incorporation by reference.

In accordance with 5 U.S.C. 552(a)(1), the publications to which references are made in this subpart are hereby incorporated by reference and made a part hereof. The incorporated publications are available for examination at each Coal Mine Health and Safety District and Subdistrict Office of MESA. ANSI publications are also available from the American National Standards, Inc., 1430 Broadway, New York, N.Y. 10018. ASME publications are also available from the American Society of Mechanical Engineers, 345 E. 47th St., New York, N.Y. 10017. Incorporation by reference provisions approved by the Director of the Federal Register on (date to be inserted prior to final rulemaking).

Subpart P—Auger Mining

§ 77.1500 Auger mining; planning.

Auger mining shall be planned and conducted by the operator to insure against any hazard to underground workings located at or near such auger operations and all auger holes shall be located so as to prevent:

(a) The disruption of the ventilation system of any active underground mine.

(b) Inundation hazards from surface water entering any active underground mine.

(c) Damage to the roof and ribs of active underground workings.

(d) Intersection of auger holes with underground mine workings known to contain dangerous quantities of impounded water.

§ 77.1501 Auger mining; inspections.

(a) The face of all highwalls, to a distace of 25 feet on both sides of each drilling site, shall be inspected by a certified person before any augering operation is begun, and at least once during each coal producing shift, and all loose hazardous material shall be removed from the drilling site before persons are permitted to enter the drilling area. The results of all such inspections shall be recorded daily in a book approved by the Secretary.

(b) In addition, the face of all highwalls, to a distance of 25 feet on both sides of each drilling site, shall be inspected frequently by a certified person during any auger operation conducted either during or after a heavy rainfall, or during any period of intermittent freezing and thawing and the results of such inspections shall be recorded as provided in paragraph (a) of this section.

(c) When an auger hole penetrates an abandoned or mined out area of an underground mine, tests for methane shall be made at the collar of the hole by a qualified person using a methane detector approved by the Secretary to determine if dangerous quantities of methane are present or being emitted. If such is found, no further work shall be performed until the atmosphere has been made safe.

(1) At least one methane detector shall be available at all times at each auger machine for the use of qualified persons.

(2) Internal combustion engines shall not be operated in the vicinity of any auger hole in which tests for methane are being made.

§ 77.1502 Auger holes; restriction against entering.

No person shall be permitted to enter an auger hole except with the approval of the Coal Mine Health and Safety District Manager or Subdistrict Manager of the district in which the mine is located and under such conditions as may be prescribed by him.

§ 77.1503 Auger equipment; overhead protection.

(a) Auger machines which are exposed to highwall hazards, together with all those parts of any coal elevating conveyors, where persons are required to work during augering operations, shall be covered with heavy gauge screen which does not obstruct the view of the highwall and is strong enough to prevent injuries to persons from spalling material.

(b) No work shall be done under any overhang and, when a crew is engaged in connecting or disconnecting auger sections under a highwall, at least one person shall be assigned to observe the highwall for possible movement.

§ 77.1504 Auger equipment; operation.

(a) Persons shall be kept clear of the auger train while it is in motion and shall not be permitted to pass under or over an auger train, except where adequate crossing facilities are provided.

(b) Persons shall stay clear of auger sections being swung into position.

(c) No person, including the auger machine operator, shall be stationed in direct line with the borehole during augering operations.

(d) The operator of auger equipment shall not leave the controls of such equipment while the auger is in operation.

§ 77.1505 Auger holes; blocking.

Auger holes shall be blocked with inert material to within 200 feet of the active working area. All auger holes shall be blocked with inert material within 30 days after the hole has been drilled.

Subpart Q—Loading, Haulage, Stripping, Drilling and Reclamation

§ 77.1600 Loading, haulage stripping, drilling and reclamation areas; general.

(a) Only authorized persons shall be permitted on roads on coal mine property at loading, dumping, stripping, drilling and reclamation areas.

(b) Traffic rules, signals and warning signs shall be standardized at each mine and conspicuously posted.

(c) Where side or overhead clearances on any haulage road or at any loading or dumping location at the mine are hazardous, such areas shall be conspicuously marked or warning devices shall be installed.

(d) Guard nets or other suitable protection against spillage shall be provided where a tramway, roadway, elevated track or any type of conveyor passes over a roadway, walkway or building.

(e) Chute-loading installations shall be designed so that the persons pulling chutes are not required to be in a hazardous position during loading operations.

(f) Cabs of self-propelled equipment shall be kept free of extraneous materials.

(g) Operators shall sit facing the direction of travel while operating equipment with dual controls.

(h) When an equipment operator is present, persons shall notify him before getting on or off equipment.

(i) Equipment operators shall be certain, by signal or other means, that all persons are clear before starting or moving equipment unless the equipment is designed to have persons board and leave it safely without such notification.

(j) Dust control measures shall be taken where dust significantly reduces visibility of equipment operators.

§ 77.1601 Transportation of persons; restrictions.

No person shall be permitted to ride or be otherwise transported on or in the

following equipment whether loaded or empty:

(a) Dippers, shovels, buckets, forks, and clamshells.

(b) The cargo space of dump trucks or haulage equipment used to transport coal or other material.

(c) Outside the cabs and beds of self-propelled equipment.

(d) Chain, belt, or bucket conveyors, except where such conveyors are specifically designed to transport persons.

§ 77.1602 Use of aerial tramways to transport persons.

(a) Persons shall not ride loaded buckets on aerial tramways.

(b) Persons other than maintenance persons shall not ride empty buckets on aerial tramways. Prior to maintenance persons riding aerial tramways, an examination of the protective safety devices required in paragraphs (b) (1) through (b) (4) of this section shall be made and a record kept of such examinations. When maintenance men ride empty aerial tramways, the following shall be provided:

(1) Two independent brakes, each capable of stopping and holding the maximum load.

(2) Direct communication between terminals.

(3) Power drives with emergency power available in case of primary power failure.

(4) Buckets equipped with positive locks to prevent accidental tripping or dumping.

§ 77.1603 Aerial tramways; installations; operations.

(a) Positive-action type brakes shall be provided on aerial tramways.

(b) Guards shall be installed to prevent swaying buckets from hitting the towers of aerial tramways.

(c) Aerial tramway cable connections shall be designed to offer minimum obstruction to the passage of wheels.

(d) Rocker-bottom or bottom-dump cars shall be equipped with positive locking devices, or other suitable devices.

(e) When the entire length of an aerial tramway is visible from the starting switch, the operator shall visually check to make certain that all persons are in the clear before starting such equipment. When the entire length of such equipment is not visible from the starting switch, an audible alarm system shall be installed and operated to warn persons that such equipment will be started.

(f) Aerial tram buckets shall not be overloaded, and feed shall be regulated to prevent spillage.

§ 77.1604 Conveyors; installations; operations.

(a) When the entire length of a conveyor is visible from the starting switch, the operator shall visually check to make certain that all persons are in the clear before starting such equipment. When the entire length of such equipment is not visible from the starting switch, an audible alarm system shall be installed and operated to warn persons that such equipment will be started.

(b) Unguarded conveyors with walkways shall be equipped with emergency stop devices or cords along their full length.

(c) Adequate backstops or brakes shall be installed on inclined-conveyor drive units to prevent conveyors from running in reverse, or out of control in the forward direction, if a hazard to personnel would be caused.

(d) Before startup of equipment in a preparation plant and in the event of an emergency in such plant, an audible alarm shall be sounded.

§ 77.1605 Railroad trains; installations; operations.

(a) Only authorized persons shall ride on a train or locomotive, and they shall ride in a safe position.

(b) Persons shall not get on or off moving equipment.

(c) No man-trip vehicle or other track conveyance used to transport persons to and from work areas shall be overcrowded, and all persons shall ride in a safe position.

(d) Supplies, materials, and tools other than handtools shall not be transported with persons in man-trip vehicles unless such vehicles are specifically designed to make such transportation safe.

(e) All self-propelled rail haulage equipment shall be provided with hydraulic brakes, pneumatic brakes or dynamic braking in addition to manual brakes, each capable of stopping and holding the maximum load.

(f) Equipment operating speeds shall be consistent with conditions of roadways, grades, clearance, visibility, traffic, and the type of equipment used.

(g) Rocker-bottom or bottom-dump cars shall be equipped with positive locking devices, or other suitable devices.

(h) Ramps and dumps shall be of solid construction, of ample width, have ample clearance and headroom, and be kept reasonably free of spillage.

(i) Where practicable, a minimum of 30 inches continuous clearance from the farthest projection of moving railroad equipment shall be provided on at least one side of the tracks; all places where it is not possible to provide 30 inches clearance shall be marked conspicuously. If less than 18 inches continuous clearance is maintained on either side of the tracks, the area shall be barricaded against entry.

(j) Track guardrails, lead rails, and frogs shall be protected or blocked so as to prevent a person's foot from becoming wedged.

(k) Positive-acting stop-blocks, derail devices, track skates, or other adequate means shall be installed wherever necessary to protect persons from runaway or moving railroad equipment.

(l) Switch throws shall be installed to provide adequate clearance for switchmen.

(m) Where necessary, bumper blocks or the equivalent shall be provided at all track dead ends.

(n) Car droppers shall not ride on the front of moving trips or on the front of a single car which is being dropped.

(o) Cars shall be dropped at a safe rate and in a manner that will insure that the car dropper maintains a safe position while working and traveling around the cars.

(1) Safe operating procedures shall be established and maintained and shall be posted in a conspicuous place and distributed to each person engaged in car dropping operations.

(2) Cars shall be inspected for defective brakes before dropping and such defective cars shall not be loaded and shall not be dropped without the aid of hoists or equivalent means.

(3) An audible alarm shall be sounded before any car or cars are dropped.

(p) Persons shall wear and use safety belts when dropping railroad cars.

(q) Railroad cars shall not be left on sidetracks unless ample clearance is provided for traffic on adjacent tracks.

(r) Railroad cars shall not be coupled or uncoupled manually from the inside of curves unless the railroad and cars are so designed to eliminate any hazard from coupling or uncoupling cars from inside of curves.

(s) Railroad cars shall be trimmed properly when they have been loaded higher than the confines of their cargo space.

§ 77.1606 Rubber tire and crawler mounted mobile equipment; installations; operations.

(a) No mobile equipment used to transport persons to and from work areas shall be overcrowded, and all persons shall ride in a safe position.

(b) Supplies, materials, and tools other than handtools shall not be transported with persons in man-trip vehicles unless such vehicles are specifically designed to make such transportation safe.

(c) Cab windows shall be of safety glass or the equivalent, and shall be in good condition and kept clean.

(d) Self-propelled equipment shall be equipped with brakes capable of stopping and holding the maximum load. All such equipment shall be equipped with parking brakes capable of holding the maximum load.

(e) Self-propelled equipment shall be provided with an audible warning device and lights visible from both ends.

(f) Ramps and dumps shall be of solid construction, of ample width, have ample clearance and headroom, and be kept reasonably free of spillage.

(g) Berms or guards shall be provided on the outer banks of elevated roadways, or:

(1) The width of single lane roads shall be one and a half times the width of the widest vehicle that normally uses the road. The width of two lane roads shall be two and one-half times the width of the widest vehicle that normally uses the road; and

(2) The traffic control system shall require loaded haulage vehicles to be driven on the natural protected side of the elevated roadways regardless of their direction of travel; and

(3) Roadway signs and markings shall be suitable, located along the elevated roadways and at other potential hazard-

ous locations that indicate proper safeguards to be taken, such as safe vehicle speed and gear.

(h) All bridges shall be of sufficient strength to support the maximum potential load. All bridges constructed after [the effective date of this section] shall be at least one and one half times the width of the widest vehicle which regularly uses such bridge.

(i) Berms, bumper blocks, safety hooks, or similar means shall be provided to prevent overtravel and overturning at dumping locations.

(j) Equipment operating speeds shall be consistent with conditions of roadway, grades, clearance, visibility, traffic, and the type of equipment used.

(k) Dippers, buckets, loading booms, or suspended loads shall not be swung over the cabs of haulage vehicles until the drivers are out of the cabs and in safe locations.

(l) Persons shall not work or pass under the booms of any self-propelled equipment when such booms may be hazardous.

(m) Electrically powered mobile equipment shall not be left unattended unless the master switch is in the off position, all operating controls are in the neutral position, and the brakes are set or other equivalent precautions are taken against rolling.

(n) Self-propelled equipment shall not be left unattended unless the brakes are set. The wheels shall be turned into a bank or berm, or shall be blocked, when such equipment is parked on a grade.

(o) Lights, flares, or other warning devices shall be positioned to the front and rear on the traffic side or sides of parked equipment when such parked equipment creates a hazard to vehicular traffic.

(p) Dippers, buckets, scrapper blades, and similar movable parts shall be secured or lowered to the ground when not in use.

(q) Equipment which is to be hauled shall be loaded and protected to prevent sliding or spillage.

(r) When moving between work areas, the components of the equipment shall be secured in the travel position.

(s) Any load extending more than 4 feet beyond the rear of the vehicle body shall be marked clearly at the end of the projection with a warning flag by day and a warning light at night.

(t) Tow bars shall be used to tow heavy equipment and a safety chain shall be used in conjunction with each tow bar. Persons shall not be permitted to get between the towed and towing vehicles or vehicles being prepared for towing operations until both vehicles have been stopped and secured against movement.

(u) All trucks shall be trimmed properly when they have been loaded higher than the confines of their cargo space.

§ 77.1607 Dumping facilities.

(a) Dumping locations and haulage roads shall be kept reasonably free of water, debris, and spillage.

(b) Where the ground at a dumping place may fail to support the weight of a loaded dump truck, trucks shall be dumped a safe distance back from the edge of the bank.

(c) Adequate protection shall be provided at dumping locations where persons may be endangered by falling material.

(d) Grizzlies, grates, and other sizing devices at dumping and transfer points shall be anchored securely in place.

(e) If truck spotters are used, they shall be well in the clear while trucks are backing into dumping position and dumping, and they shall use lights at night to direct trucks.

10. Sections 77.1700 through 77.1710 are revised as follows:

Subpart R—Miscellaneous

§ 77.1700 Communications in work areas.

No persons shall be assigned, or allowed, or be required to perform work alone in any area where hazardous conditions exist that would endanger his safety unless he can communicate with others, can be heard, or can be seen.

§ 77.1701 Emergency communications: requirements.

(a) Each operator of a surface coal mine shall establish and maintain a communication system from the mine to the nearest point of medical assistance for use in an emergency.

(b) The emergency communication system required to be maintained under paragraph (a) of this section may be established by telephone or radio transmission or by any other means of prompt communication to any facility (for example, the local sheriff, the State highway patrol, or local hospital) which has available the means of communication with the person or persons providing emergency medical assistance or transportation in accordance with the provisions of paragraph (a) of this section.

§ 77.1702 Arrangements for emergency medical assistance and transportation for injured persons; reporting requirements; posting requirements.

(a) Each operator of a surface coal mine shall make arrangements with a licensed physician, medical service, medical clinic, or hospital to provide 24-hour emergency medical assistance for any person injured at the mine.

(b) Each operator shall make arrangements with an ambulance service, or otherwise provide for 24-hour emergency transportation for any person injured at the mine.

(c) Each operator shall report to the Coal Mine Health and Safety District Manager for the district in which the mine is located the name, title and address of the physician, medical service, medical clinic, hospital, or ambulance service with whom arrangements have been made, or otherwise provided, in accordance with the provisions of paragraphs (a) and (b) of this section.

(d) Each operator shall, within 10 days after any change of the arrangements required to be reported under the provisions of this section, report such changes to the Coal Mine Health and Safety District Manager. If such changes involve a substitution of persons, the operator shall provide the name, title, and address of the person substituted together with the name and address of the medical service, medical clinic, hospital, or ambulance service with which such person or persons are associated.

(e) Each operator shall, immediately after making an arrangement required under the provisions of paragraphs (a) and (b) of this section, or immediately after any change in such agreement, post at appropriate places at the mine the names, titles, addresses, and telephone numbers of all persons or services currently available under such arrangements to provide medical assistance and transportation at the mine.

§ 77.1703 First aid training: supervisory employees.

Within 90 days after [the effective date of this section], each operator of a surface coal mine shall conduct a first aid training course for all supervisory employees at the mine who have not had such training within one year and report in writing to the District Manager the names and job titles of all supervisory employees so trained. New supervisory employees shall be provided such training within 90 days of the date of employment as a supervisor.

§ 77.1704 First aid training program: retraining of supervisory employees.

Each operator of a surface coal mine shall conduct refresher first aid training programs each calendar year for all supervisory employees at the mine.

§ 77.1705 First aid training program: requirements.

(a) First aid training programs required under § 77.1703 shall include 10 class hours of training in a course of instruction similar to that outlined in "First Aid, A Bureau of Mines Instruction Manual."

(b) Refresher first aid training programs required under § 77.1704 shall include 5 class hours of refresher training in a course of instruction similar to that outlined in "First Aid, A Bureau of Mines Instruction Manual."

§ 77.1706 First aid equipment: location; requirements.

(a) A supply of the first aid equipment set forth in paragraph (b) of this section shall be maintained at each surface coal mine and surface work area of underground coal mine as follows:

(1) At or near each working place where coal is being mined;

(2) At each preparation plant; and,

(3) At shops and other surface installations where ten or more persons are regularly employed.

(b) The first aid equipment required to be maintained under the provisions of paragraph (a) of this section shall include at least the following:

(1) One stretcher;

(2) One broken-back board (a splint-stretcher combination may be used to satisfy the requirements of paragraphs (b)(1) and (b)(2) of this section);

(3) Twenty-four triangular bandages (15 if a splint-stretcher combination is used);
(4) Eight 4-inch bandage compresses;
(5) Eight 2-inch bandage compresses;
(6) Twelve 1-inch adhesive compresses;
(7) An approved burn remedy;
(8) Two cloth blankets;
(9) One rubber blanket or equivalent substitute;
(10) Two tourniquets;
(11) One 1-ounce bottle of aromatic spirits of ammonia or 1 dozen ammonia ampules; and,
(12) The necessary complements of arm and leg splints or two each inflatable arm and leg splints.

(c) All first aid supplies required to be maintained under the provisions of paragraphs (a) and (b) of this section shall be stored in suitable, sanitary, dust tight, moisture proof containers and such supplies shall be accessible to the miners.

§ 77.1707 Safety program for supervisory employees.

Each operator of a surface coal mine shall establish and maintain for all supervisory employees a program of instruction with respect to the safety regulations and procedures to be followed at the mine.

§ 77.1708 Distribution of safety regulations.

Each operator shall distribute to each employee, safety regulations and procedures to be followed at the mine.

§ 77.1709 [Reserved]

§ 77.1710 Protective clothing; requirements.

Each employee shall be required to wear protective clothing and devices as follows:

(a) Protective clothing or equipment and faceshields or goggles shall be worn when welding, cutting, or working with molten metal or when other hazards to the eyes exist.

(1) Eye and face protection equipment required by this subpart shall meet the requirements prescribed in American National Standards Institute (ANSI) Z87.-1–1968, "Practice for Occupational and Educational Eye and Face Protection."

(2) Employees whose vision requires the use of corrective lenses, when required by this regulation to wear eye protection, shall be protected by goggles or spectacles of one of the following types:

(i) Safety glass spectacles whose protective lenses provide optical correction.

(ii) Goggles or faceshields that can be worn over corrective lenses without disturbing the lens adjustment.

(iii) Goggles that incorporate corrective lenses mounted behind protective lenses.

(3) Face and eye protection equipment shall be kept clean and in good repair. Eye protection equipment with structural or optical defects shall not be used.

(b) Suitable protective clothing to protect the entire body when handling corrosive or toxic substances or other materials which might cause injury to the skin.

(c) Protective gloves when handling materials or performing work which might cause injury to the hands; however, gloves shall not be worn where they would create a greater hazard by becoming entangled in the moving parts of equipment.

(d) A suitable hard hat or cap when in or around a mine or plant where falling objects or exposed electric circuits may create a hazard.

(1) Hard hats or caps used for protection against impact and penetration of falling or flying objects shall meet specifications for helmets prescribed in American National Standards Institute (ANSI) Z89.1–1969, "Safety Requirements For Industrial Head Protection."

(2) Hard hats or caps used for head protection of employees exposed to electrical shock and burns shall meet specifications for helmets as prescribed in American National Standards Institute (ANSI) Z89.2, 1971, "Safety Requirements For Industrial Protective Helmets For Electrical Workers, Class B."

(e) Suitable protective footwear.

(f) Snug-fitting clothing when working around moving machinery or equipment.

(g) Safety belts and lines where there is danger of falling; a second person shall tend the lifeline when bins, tanks, or other dangerous areas are entered.

(1) Lifelines, safety belts, and lanyards shall be used only as an employee safeguard. Any lifeline, safety belt, or lanyard actually subjected to in-service loading, as disinguished from static load testing, shall be immediately removed from service and shall not be used again as an employee safeguarding device.

(2) Where possible, lifelines shall be secured above the point of operation to an anchorage or structural member capable of supporting a minimum dead weight of 5,400 pounds.

(3) Safety belt lanyards shall be constructed of a minimum of ½-inch nylon or equivalent material, with a maximum length to provide for a fall not greater than 6 feet. The rope shall have a nominal breaking strength of 5,400 pounds.

(4) All safety belt and lanyard hardware, except rivets, shall be capable of withstanding a tensile loading of 4,000 pounds without fracturing or taking a permanent deformation.

(h) U.S. Coast Guard approved lifejackets or belts where there is danger from falling into water.

(i) Seatbelts in a vehicle where there is a danger of overturning and where roll protection is provided.

(1) Seatbelts shall meet the requirements of the Society of Automotive Engineers (SAE), "Motor Vehicle Seatbelts Assemblies"—SAE J4c, approved November 1955, revised July 1965; "Seatbelt Hardware Test Procedures"—SAE J140a, approved April 1970, revised February 1973; and "Seatbelt Hardware Performance Requirements"—SAE J141 and "Seatbelts for Construction Equipment"—SAE J386, approved March 1968.

11. Sections 77.1711 through 77.1713 are revised and a new § 17.1714 is added as follows:

§ 77.1711 Smoking prohibition.

No person shall smoke or use an open flame where such practice may cause a fire or explosion.

§ 77.1712 Reopening mines; notifications; inspection prior to mining.

Prior to reopening any surface coal mine after it has been abandoned or declared inactive by the operator, the operator shall notify the Coal Mine Health and Safety District Manager for the district in which the mine is located, and an inspection of the entire mine shall be completed by an authorized representative of the Secretary before any mining operations in such mine are instituted.

§ 77.1713 Daily inspection of surface working areas and installations; certified persons; reports of inspection.

(a) At least once during each working shift, or more often if necessary for safety, each active working area and each active surface installation shall be examined by a certified person designated by the operator to conduct such examinations for hazardous conditions and any hazardous conditions noted during such examinations shall be reported to the operator and shall be corrected by the operator.

(b) If any hazardous condition noted during an examination conducted in accordance with paragraph (a) of this section creates an imminent danger, the person conducting such examination shall notify the operator and the operator shall withdraw all persons from the area affected, except those persons referred to in section 104(d) of the Act, until the danger is abated.

(c) After each examination conducted in accordance with the provisions of paragraph (a) of this section, each certified person who conducted all or part of the examination required shall enter with ink or indelible pencil in a book approved by the Secretary the date and a report of the condition of the mine or any area of the mine which he has inspected together with a report of the nature and location of any hazardous condition found to be present at the mine. The book in which such entries are made shall be kept in an area at the mine designated by the operator to minimize the danger of destruction by fire or other hazard.

(d) All examination reports recorded in accordance with the provisions of paragraph (c) of this section shall include a report of the action taken to abate hazardous conditions and, shall be signed by the person making the inspection and shall be signed or countersigned each day by at least one of the following persons:
(1) The general foreman;
(2) The assistant superintendent;
(3) The superintendent; or,
(4) The person designated by the operator as responsible for health and safety.

§ 77.1714 Incorporation by reference.

In accordance with 5 U.S.C. 552(a)(1), the publications to which references are made in this subpart are hereby incorporated by reference and made a part hereof. The incorporated publications are available for examination at each Coal Mine Health and Safety District and Subdistrict Office of MESA. Bureau of Mines publications are also available from the Assistant Administrator—Coal Mine Health and Safety, MESA, 4015 Wilson Blvd., Arlington, Va. 22203. ANSI publications are also available from the American National Standards, Inc., 1430 Broadway, New York, N.Y. 10018. SAE publications are also available from the Society of Automotive Engineers, Inc., Two Pennsylvania Plaza, New York, N.Y. 10001. Incorporation by reference provisions approved by the Director of the Federal Register on (date to be inserted prior to final rulemaking).

12. Subparts S and T are revised as follows:

Subpart S—Trolley Circuits

§ 77.1800 Protection of trolley circuits.

(a) Except as provided in paragraph (b) of this section, trolley circuits shall be protected against short-circuit and ground-fault by circuit breakers as prescribed in §§ 77.1800–1 and 77.1800–2.

(b) Trolley circuits in which the track rail serves as the grounded power conductor shall be protected against short-circuit by circuit breakers as prescribed in § 77.1800–1.

§ 77.1800–1 Short-circuit protection; requirements.

Where a circuit breaker provides short-circuit protection for a trolley circuit, such circuit breaker shall be equipped with a device which shall be adjusted to trip the circuit breaker when the current in any ungrounded power conduetor exceeds 70 percent of the lowest value of bolted short-circuit current at any point in the circuit. Such short-circuit device shall cause the circuit breaker to trip within 75 milliseconds for short-circuit current flow equivalent to 200 percent of the device setting.

§ 77.1800–2 Ground-fault protection; requirements.

Where a circuit breaker provides ground-fault protection for a trolley circuit, such circuit breaker shall be equipped with a device which shall be adjusted to trip the circuit breaker when the ground-fault current in any ungrounded power conductor exceeds 50 percent of the lowest value of a bolted ground-fault current at any point in the circuit. Such ground-fault device shall cause the circuit breaker to trip within 75 milliseconds for ground-fault current flow equivalent to 200 percent of the device setting.

§ 77.1800–3 Reclosing circuit breakers; requirements.

(a) All circuit breakers installed to comply with § 77.1800(a) shall not automatically reclose after tripping due to a ground-fault.

(b) All circuit breakers installed to protect trolley circuits energized at more than 660 volts shall not automatically reclose after tripping.

(c) All circuit breakers installed to comply with § 77.1800 which automatically reclose after tripping shall be equipped with a load measuring device which shall prevent the circuit breaker from reclosing whenever the load current would exceed 300 amperes or 15 percent of the setting of the short-circuit device, whichever is lower.

(d) Tie-feeder and multi-feeder circuit breakers installed to comply with § 77.1800 which automatically reclose after tripping shall be equipped with a voltage differential device which shall prevent the circuit breaker from reclosing whenever the voltage across the circuit breaker exceeds 15 percent of the nominal circuit voltage; except that whenever the voltage across the circuit breaker exceeds 85 percent of the nominal circuit voltage, the load measuring devices shall determine whether the circuit breaker will reclose.

§ 77.1800–4 Circuit breakers and associated devices; test and adjustment requirements.

(a) Circuit breakers and associated devices required by this subpart shall be tested and adjusted by a qualified person at intervals not exceeding 6 months. Such tests and adjustments shall be made in accordance with the following:

(1) Except as provided in paragraph (a)(2) or (a)(3) of this section, direct-current circuit breakers shall be tested by passing sufficient current from a calibrated current source through the circuit breaker to cause the circuit breaker to trip.

(2) Direct-current circuit breakers which utilize electromechanical short-circuit devices with calibration coils shall be tested in accordance with paragraph (a)(1) of this section or shall be tested by passing sufficient current from a calibrated current source through the calibration coil to cause the circuit breaker to trip.

(3) Direct-current circuit breakers which utilize shunt operated electronic short-circuit and ground-fault devices shall be tested in accordance with paragraph (a)(1) of this section or shall be tested by:

(i) Testing the short-circuit and ground-fault devices with a calibrated voltage source to verify that such devices operate at the indicated setting;

(ii) Testing the circuit from the shunt to the short-circuit and ground-fault devices to verify continuity; and

(iii) Tripping the circuit breaker by electrically or manually operating the short-circuit and ground-fault devices.

(4) Except as provided in paragraph (a)(5) of this section, alternating-current circuit breakers shall be tested by passing sufficient current from a calibrated current source through the circuit breaker to cause the circuit breaker to trip.

(5) Alternating-current circuit breakers which utilize current transformer operated short-circuit and ground-fault devices shall be tested in accordance with paragraph (a)(4) of this section or shall be tested by:

(i) Testing the short-circuit and ground-fault devices with a calibrated current source to verify that such devices operate at the indicated setting;

(ii) Testing the circuit from the current transformer secondary to the short-circuit and ground fault devices to verify continuity; and

(iii) Tripping the circuit breaker by electrically or manually operating the short-circuit and ground-fault devices.

(6) Load measuring devices and voltage differential devices shall be tested to assure proper operation.

(7) Short-circuit devices, ground-fault devices, load measuring devices and voltage differential devices shall be adjusted to an accuracy of not less than ±10 percent of the indicated setting.

(8) Voltage sources and current sources used to test and adjust circuit breakers and associated devices shall possess an accuracy of not less than ±5 percent.

(b) An authorized representative of the Secretary may require additional testing of circuit breakers and associated devices.

(c) A record of the tests required by this section shall be kept and shall be made available to an authorized representative of the Secretary.

§ 77.1801 Trolley wires and trolley feeder wires; support.

Trolley wires and trolley feeder wires shall be securely attached to each support by proper insulators designed for the duty involved.

§ 77.1802 Cutout switches.

Trolley wires and trolley feeder wires shall be provided with cutout switches at intervals of not more than 2,000 feet and near the beginning of all branch lines.

§ 77.1803 Repairs to energized trolley wires.

Trolley wires, energized at 660 volts or less, may be repaired by a person who has been trained in accordance with the requirements of § 77.1803–1. Persons who make repairs to energized trolley wires shall wear rubber boots or rubber overshoes, and protective gloves which meet American Society for Testing and Materials (ASTM) "Standard Specification for Rubber Insulating Gloves" (D120–70) for Class Zero rubber insulation gloves.

§ 77.1803–1 Repairs to energized trolley wires; training.

The training required by § 77.1803 shall include at least 4 hours of training in the repair and maintenance of energized trolley wires, in the hazards in making such repairs, in the limitations and inspections of protective clothing and in the treatment of electrical shock. A record of such training shall be kept and made available to an authorized representative of the miners and to an authorized representative of the Secretary.

§ 77.1803–2 Protective gloves; inspection.

Protective gloves worn while making repairs to energized trolley wires shall be inspected for defects before each use. Defective gloves shall not be used.

§ 77.1804 Incorporation by reference.

In accordance with 5 U.S.C. 552(a)(1), the American Society for Testing and Materials publication to which reference is made in this subpart is hereby incorporated by reference and made a part hereof. The incorporated publication is available for examination at each Coal Mine Health and Safety District and Subdistrict Office of MESA. It is also available from the American Society for Testing and Materials, 1916 Race St., Philadelphia, Pa. 19103. Incorporation by reference provisions approved by the Director of the FEDERAL REGISTER on (date to be inserted prior to final rulemaking).

Subpart T—Slope and Shaft Sinking

§ 77.1900 Slopes and shafts; plan.

Each operator shall establish and follow a slope and shaft plan, approved in accordance with §§77.1900–1 through 77.1900–4, providing for the safety of persons in each slope of shaft that is commenced or extended. The methods employed by the operator shall be selected to minimize hazards to those employed in the initial and subsequent development of the slope or shaft.

§ 77.1900–1 Filing of a slope and shaft plan.

Each operator, prior to the commencement or extension of a slope or shaft sinking operation, shall file a slope and shaft plan with the District Manager of theh Coal Mine Health and Safety District in which the slope or shaft is located.

§ 77.1900–2 Approval of plans.

The operator shall be notified in writing of the approval or disapproval of his slope and shaft plan. If the District Manager determines that revisions are required before the slope and shaft plan can be approved, the revisions required shall be specified and the operator shall be afforded an opportunity to discuss the revisions.

§ 77.1900–3 Information required in slope and shaft plan.

Slope and shaft plans shall include but not be limited to the following information:

(a) Name and address of the contractor and/or operator performing the work.

(b) Name, identification number, and address of the mine.

(c) A surface map showing:

(1) Georgraphic location of slope or shaft;

(2) Surface drainage and impoundments;

(3) Known underground workings or construction projects within 500 feet; and

(4) Dumping area.

(d) Drawings with dimensions of hoisting facilities.

(e) Specifications of hoisting apparatus showing:

(1) Size, capacity and safety factor of ropes, motors, drums, headframe, brakes and sheaves;

(2) Methods of rigging;

(3) Distance from head sheave to nearest rope attachment after overwind device is actuated; and

(4) Emergency hoisting devices.

(f) Operational sequences for initial and subsequent excavation:

(1) Clean-up for drilling;

(2) Drilling;

(3) Loading of explosives;

(4) Blasting including type and quantities of explosives, pattern, type of stemming materials, type of blasting device, and use of galvanometer;

(5) Loading and transportation of broken material;

(6) Installation of temporary or permanent service line; and

(7) Placement of linings, concrete forms, and work platforms.

(g) Roof and rib, or shaft wall control including method of examining and scaling, type of support and method of installing support.

(h) Ventilation including size and capacity of fan, and type and location of vent tubing.

(i) General characteristics of strata.

§ 77.1900–4 Modification of approved slope and shaft plans.

Each operator, prior to initiating a modification of any approved slope and shaft plan, shall file such modification with the District Manager. The operator shall be notified in writing of the approval or disapproval of his modification. If the District Manager determines that revisions are required before the modification can be approved, the revisions required shall be specified and the operator shall be afforded an opportunity to discuss the revisions.

§ 77.1901 Preshift and onshift inspections.

(a) Examinations of slope and shaft areas shall be made by a certified person for hazardous conditions, including tests for methane and for oxygen deficiency, as follows:

(1) Within 90 minutes before each shift;

(2) At least once on any shift during which persons are working inside any slope or shaft; and

(3) Both before and after blasting.

(b) The surface area surrounding each slope and shaft shall be inspected by a certified person and all hazardous conditions in the vicinity shall be corrected before persons are permitted to enter the excavation.

(c) All hazardous conditions found during any preshift or onshift inspection required by paragraph (a) of this section shall be corrected before persons are allowed to enter or continue to work in such slope or shaft. If any hazardous condition creates an imminent danger, the operator shall withdraw all persons from the excavation, except those persons referred to in section 104(d) of the Act, and no person shall be permitted to reenter the slope or shaft to continue slope and shaft sinking operations until the imminent danger has been abated. A methane content of 1.5 volume per centum or more shall be considered an imminent danger.

(d) No work shall be performed in any slope or shaft, no drilling equipment shall be started, and no electrical equipment shall be energized if the methane content in such slope or shaft is 1.0 volume per centum or more.

(e) Nothing in this section shall prevent the specific assignment of persons in the slope or shaft for purposes of abating excessive methane concentrations or any other hazardous condition.

(f) The results of all inspections conducted in accordance with this section shall be recorded daily in a book approved by the Secretary, and shall be signed by the person making the inspection and shall be signed or countersigned daily by any of the persons listed in § 77.1713(d).

§ 77.1901–1 Methane and oxygen deficiency tests; approved devices.

Tests for oxygen deficiency shall be made with a permissible flame safety lamp or other means approved by the Secretary, and tests for methane shall be made with a methane detector approved by the Secretary.

§ 77.1902 Drilling and mucking operations.

Diesel-powered equipment used in the drilling, mucking, or other excavating operation in any slope or shaft shall be permissible. Such equipment shall be operated in a permissible manner, shall be maintained in a permissible condition, and shall be provided with at least one portable fire extinguisher.

§ 77.1902–1 Permissible diesel-powered equipment.

Diesel-powered equipment which has been approved by the Bureau of Mines or the Mining Enforcement and Safety Administration under Part 36 of this chapter (Bureau of Mines Schedule 31) is permissible under the provisions of § 77.1902.

§ 77.1903 Hoists and hoisting.

(a) Loads handled by hoists employed in transporting persons or material in any slope or shaft shall not exceed the rated capacities of the hoist, the rope fastenings used, and the static load safety factors of the ropes used on such hoists as prescribed in paragraph (c) of this section. The rated capacities shall be as stated by the manufacturer or certified by a registered engineer. The rated capacity shall be posted within the view of the hoistman.

(b) American National Standards Institute, "Specifications for the Use of Wire Ropes for Mines," M11.1–1960, shall be used as a guide in the use, selection, installation, and maintenance of wire ropes.

(c) The following static load safety factors shall be used for selecting ropes

to be used on hoists and for determining when such ropes shall be removed from hoists:

Length of rope in shaft (feet)	Minimum factor of safety (new rope)	Minimum factor of safety (remove)
500 or less	8	6.4
501 to 1,000	7	5.8
1,001 to 2,000	6	5.0
2,001 to 3,000	5	4.3
3,001 or more	4	3.6

(d) Wire rope shall be removed when inspection shows:

(1) Six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay. Snagged, nicked or severely bent wires shall be counted as broken wires; or

(2) Abrasion, scrubbing or peening causing loss of more than ⅓ the original diameter of the outside individual wires; or

(3) Evidence of rope deterioration from corrosion; or

(4) Kinking, crushing or other damage that results in distortion of the rope structure; or

(5) Reduction in nominal rope diameter determined as follows:

(i) 1/64 inch for rope diameters up to and including 5/16 inch;

(ii) 1/32 inch for rope diameters 3/8 inch to ½ inch inclusive;

(iii) 3/64 inch for rope diameters 9/16 inch to ¾ inch inclusive;

(iv) 1/16 inch for rope diameters 7/8 inch to 1⅛ inches inclusive;

(v) 3/32 inch for rope diameters 1¼ inches to 1½ inches inclusive;

(vi) Rope diameters over 1½ inches, as recommended by the wire rope manufacturer.

(e) Wire rope attachments shall be replaced when inspection shows:

(1) Improper installation of attachment; or

(2) Cracked, deformed, excessively worn, or loosened attachments; or

(3) Wire rope slippage at attachment; or

(4) More than one broken wire at the point of attachment of a spelter filled or swaged attachment.

(f) Each hoist employed in drilling, mucking or other exacavating operations shall be equipped with an accurate and reliable indicator of the position of the conveyance, except where the conveyance is visible at all times to the hoistman. The indicator shall be driven from the hoist drum or drum shaft by a chain, gear or other direct drive and show the position of the conveyance at all times. The indicator shall be placed so that it is in clear view of the hoistman.

(g) Hoist drive units shall be protected from the weather, and the mechanism that operates the brakes shall be guarded to prevent material or tools from accidentally fouling or jamming the brake system.

§ 77.1904 Communications between slope and shaft bottoms and hoist operators.

At least two independent means of signaling shall be provided between the hoistman and all points in a slope or shaft where persons are required to work. At least one of these means shall be audible to the hoistman. Signal codes used in any communication system shall be standardized and posted conspicuously at each slope and shaft and in clear view of the hoistman.

§ 77.1905 Hoist safeguards; general.

(a) Hoists used to transport materials shall be equipped with brakes capable of safely stopping and holding the cage, bucket, platform, or other conveyance when fully loaded. Such conveyances shall not be lowered by the brakes alone, except in an emergency.

(b) When persons are transported by a hoist or when persons may be endangered by the hoisting operation, such hoist shall meet the requirements of Subpart O of this part.

§ 77.1906 Hoists; inspection and maintenance.

Hoists shall be inspected daily and shall be maintained in accordance with § 77.1403.

§ 77.1907 Hoist construction; general.

(a) Hoisting ropes shall be equipped with a spelter-filled socket, wedge socket, or thimble with an adequate number of clips properly spaced and installed along the rope.

(b) Cages, buckets, or slope cars when used for transporting persons shall be provided with two bridle chains or cables connected securely to the rope at least 3 feet above the socket or at least 3 feet above the last rope clip if a thimble is used and which shall be securely fastened to the cage, bucket or slope car.

(c) Where hooks are used to attach cages, buckets, or other conveyances to the socket or thimble of a hoisting rope, such hooks shall be self-closing.

(d) At least three full turns of rope shall remain on the hoist drum when the rope is extended to its maximum working length. At least one full turn of the hoist rope shall be placed around the drum shaft or around the spoke of a free drum and shall be fastened securely by means of rope clips or clamps, except where hoist drums are designed with proper rope terminations.

(e) Self-dumping conveyances used for transporting persons shall have a locking mechanism to prevent dumping or tilting when persons are transported.

§ 77.1908 Hoist installations; use.

(a) Where persons are transported by means of a hoist and the depth of the shaft exceeds 50 feet, the hoist rope shall be suspended from a hoisting installation capable of withstanding forces at least equal to the breaking strength of the hoist rope.

(b) Where persons are transported by means of a hoist and the depth of the shaft exceeds 100 feet, temporary shaft guides and guide attachments shall be installed to prevent the cage, platform, bucket, or other conveyance from swinging, unless the District Manager approves other means which will provide no less than the same degree of protection to persons being transported.

(c) All guides and guide attachments installed in accordance with paragraph (b) of this section shall be maintained to a depth of not more than 75 feet from the bottom of the shaft.

(d) Where crossheads are used, the cage, bucket, or other conveyance shall not be hung more than 10 feet below the crosshead.

(e) Where persons are required to embark or disembark over or within a shaft, a loading platform shall be installed to insure safe footing.

(f) During the development of each slope or shaft, either a ladder or independently powered auxiliary hoist shall be provided to permit persons to escape quickly in the event of an emergency.

(g) No person shall be permitted to ride the rim of any bucket or on the top of a loaded bucket.

(h) The maximum number of persons permitted to ride the conveyance at one time shall be posted conspicuously at the point of entrance to the shaft or slope.

(i) Persons shall not be permitted to ride on a conveyance with tools or materials, other than small hand tools.

(j) The speed of a conveyance transporting persons shall not exceed 500 feet per minute and not more than 200 feet per minute when within 100 feet of any stop.

(k) A notice of established speeds shall be posted in clear view of the hoistman.

(l) Conveyances being lowered in a shaft in which persons are working shall be stopped at least 15 feet above such persons and shall be lowered further only after the hoistman has received a signal that all persons who may be endangered by the conveyance are in the clear.

(m) No conveyance shall be raised or lowered in a slope or shaft until it has been stabilized and trimmed.

(n) Measures shall be taken to prevent material from falling back into the shaft while buckets or other conveyances are being unloaded.

(o) Properly attached safety belts shall be worn by all persons required to work in or over any shaft where there is a drop of 10 or more feet, unless other acceptable means are provided to prevent such persons from falling into the shaft.

§ 77.1908–1 Hoist operation; qualified hoistman.

Hoists shall be under the control of and operated by a qualified hoistman when persons are being transported or when persons are in a slope or shaft.

§ 77.1909 Explosives and blasting; use of permissible explosives and shot-firing units.

Except as provided in §§ 77.1909–1 and 77.1909–2, only permissible explosives and permissible shot-firing units shall be

used in slopes and shaft sinking operations.

§ 77.1909–1 Use of nonpermissible explosives; approval.

Where the District Manager of the Coal Mine Health and Safety District in which the slope or shaft is located has determined that the use of nonpermissible explosives will not pose a hazard to any persons during the development of a slope or shaft, he may, after written application by the operator, approve the use of such explosives and issue a permit setting forth the safeguards to be employed by the operator to protect the health and safety of any person exposed to such blasting.

§ 77.1909–2 Use of nonpermissible shot-firing device.

A nonpermissible shot-firing device may be used provided that all persons are removed to a safe location on the surface prior to the connection of the shooting cable to the blasting device.

§ 77.1910 Explosives and blasting: general.

(a) Light and power circuits shall be disconnected or removed from the blasting area before charging and blasting.

(b) All explosive materials, detonators, and any other related blasting material employed in the development of any slope or shaft shall be stored, transported, carried, charged, and fired in accordance with the provisions of Subpart N of this part. Except as provided in paragraph (c) of this section, all shots shall be fired from the surface.

(c) Where tests for methane have been conducted and methane has not been found and only permissible blasting units are being employed, shots may be fired from an upper level of the slope or shaft.

(d) Except as provided in paragraph (c) of this section, all persons shall be removed from the slope or shaft prior to blasting.

(e) Blasting areas in slopes or shafts shall be covered with mats or other suitable material when the excavation is too shallow to retain basted material.

(f) Where it is impracticable to prepare primers in the blasting area, only the number of primers needed for one round of shots shall be prepared and remain on the surface in an isolated area prior to use. The primers shall be carried in insulated, covered containers.

(g) No other development operation shall be conducted in a shaft or at the face of a slope while holes are being charged and until after all shots have been fired.

(h) The slope or shaft shall be examined after each blast and loose material shall be removed.

(i) Loose rock and other material shall be removed from timbers and platforms after each blast before persons are lowered to the shaft bottom.

§ 77.1911 Ventilation of slopes and shafts.

(a) All slopes and shafts shall be ventilated by mechanical ventilation equipment during development. Mechanical ventilation equipment shall be examined before each shift by a person trained by the operator to perform such examination. The quality and quantity of air in the slope or shaft shall be determined each shift by a person trained by the operator to make such determination. The results of such examinations and measurements shall be recorded in a book approved by the Secretary and shall be signed by the person making the examinations and measurements, and countersigned daily by any of the persons listed in § 77.1713(d).

(b) Ventilation fans shall be:

(1) Installed on the surface;

(2) Installed in noncombustible housing;

(3) Designed to permit the reversal of the air current, and located in an area which will prevent a recirculation of air from the slope or shaft or air contamination from any other source;

(4) Equipped with an automatic signal device designed to give an alarm in the event the fan slows or stops which can be seen or heard by any person on duty in the vicinity of the fan, except where fans are constantly attended;

(5) Offset not less than 15 feet from the shaft or slope; and

(6) Equipped with air ducts which are noncombustible and maintained so as to prevent excessive leakage of air.

(i) Flexible ducts shall be constructed to permit ventilation by either exhausting or blowing methods and when metal air ducts are used, they shall be grounded effectively to remove static and other electrical charges; and

(ii) Ducts shall extend as close to the bottom as necessary to keep the face clear of dangerous and noxious gases. "Face" as used in this subpart means where excavating is progressing or was last done.

(c) Each ventilating system shall be properly maintained by a person trained by the operator to perform such maintenance.

(d) The fan shall be operated at least one half hour prior to entering the underground area of a slope or shaft by any persons and shall be operated continuously when persons are below the surface. Any accidental stoppage or reduction in air flow shall be corrected immediately. If such corrections cannot be made immediately, development work below the surface shall be stopped, and all persons not needed to make necessary corrections to the ventilation system shall be removed to the surface.

§ 77.1912 Ladders and stairways.

(a) Substantial stairways or ladders shall be used during the construction of all shafts where no mechanical means are provided for persons to travel.

(b) Landings at intervals of not more than 30 feet shall be installed.

(c) Shaft ladders shall project 3 feet above the collar of the shaft, and shall be placed at least 6 inches from the side of the shaft.

§ 77.1913 Fire-retardant wood.

All wood products, with the exception of crossties, which are permanently installed in slopes and shafts shall be fire-retardant.

§ 77.1914 Electric equipment.

(a) All electric cap lamps used below the collar of a slope or shaft shall be approved by MESA as permissible and shall be maintained in permissibe condition.

(b) All other electric equipment used below the collar of a slope on shaft shall be:

(1) Approved by MESA as permissible, installed in a permissible manner and maintained in permissible condition; or

(2) Listed by Underwriters' Laboratories, Inc. or Factory Mutual, Inc. as suitable for use in Class I, Group D and Class II, Group F locations and installed and maintained in accordance with Article 501 and 502 of the National Electrical Code, 1975.

(c) The outer jacket or covering of all conductors and cables used below the collar of a slope or shaft, except conductors installed in rigid metal conduit and conductors used in an intrinsically safe circuit, shall meet the requirements for flame resistant cables as set forth in § 18.64 of this chapter.

(d) For the purposes of this part, all electric equipment, other than self-propelled electric equipment, which is used below the collar of a slope or shaft shall be considered portable electric equipment.

(e) The voltage of alternating current systems which supply power to portable lighting fixtures used below the collar of a slope or shaft shall not exceed 70 volts to ground.

(f) The voltage of direct current systems which supply power to portable lighting fixtures used below the collar of a slope or shaft shall not exceed 150 volts to ground.

(g) (1) In addition to the requirements of §§ 77.901 and 77.901–1, alternating current systems energized at 100 volts or more which supply power to portable lighting fixtures used below the collar of a slope or shaft shall contain either a direct or derived neutral which shall be grounded through a suitable resistor to a low-resistance grounding medium at the power source.

(2) A ground wire which meets the requirements of § 77.520 shall originate at the grounded side of the grounding resistor. Such ground wire shall be connected to the metallic frames and enclosures of the power source and shall extend along with the power conductors and serve as the grounding circuit for:

(i) The metallic frames and other metallic enclosures of all portable and self-propelled equipment supplied power from the system, and

(ii) The metallic enclosures of all circuits which are supplied power from the system and extend to portable and self-propelled equipment.

(3) Such grounding resistor shall be of the proper ohmic value to limit the ground fault current to no more than 5

amperes. The ground fault current rating of the grounding resistor shall meet the "extended time rating" set forth in Institute of Electrical and Electronic Engineers, Inc. Standard No. 32 (IEEE) Standard 32-1972. The grounding resistor shall be insulated from ground for a voltage not less than the phase-to-phase, or line-to-line, voltage of the system in which it is installed.

(h) Lighting fixtures which are mounted on a unit of self-propelled electric equipment shall be grounded to the equipment frame by means of a separate ground wire which meets the requirements of § 77.520.

§ 77.1915 Storage and handling of combustible materials.

(a) Liquefied and nonliquefied compressed gas cylinders, and oil, gasoline and other petroleum products shall not be stored within 100 feet of any slope or shaft opening.

(b) Combustible material and supplies, other than those specified in paragraph (a) of this section, shall not be stored within 25 feet of any slope or shaft opening.

(c) Pyritic slates, bony coal, culm or other material capable of spontaneous combustion shall not be used for fill or as surfacing material within 100 feet of any slope or shaft opening.

(d) Areas surrounding the opening of each slope or shaft shall be constructed to insure the drainage of flammable liquids away from the slope or shaft in the event of spillage.

(e) Oily rags, waste, waste paper, and other combustible waste material disposed of within, or in the vicinity of any slope or shaft opening shall be stored in closed, noncombustible containers until removed from the area.

§ 77.1916 Welding, cutting and soldering; fire protection.

(a) At least one portable fire extinguisher shall be provided where welding, cutting or soldering with arc or flame is performed.

(b) Welding, cutting or soldering with arc or flame in any slope or shaft, or within the vicinity thereof, except where such operations are performed in fireproof enclosures, shall be done under the supervision of a qualified person who shall make a diligent search within or in the vicinity of the slope or shaft for fire during and after such operations.

(c) Before welding, cutting or soldering is performed in any slope or shaft, an examination for methane shall be made by a qualified person with a device approved by the Secretary for detecting methane. Examinations for methane should be made immediately before and periodically during welding, cutting or soldering and such work shall not be permitted to commence or continue in air which contains 1.0 volume per centum or more of methane.

(d) Noncombustible barriers shall be installed below welding, cutting or soldering operations in or over a shaft.

§ 77.1917 Incorporation by reference.

In accordance with 5 U.S.C. 552(a)(1), the publications to which references are made in this subpart are hereby incorporated by reference and made a part hereof. The incorporated publications are available for examination at each Coal Mine Health and Safety District and Subdistrict Office of MESA. ANSI publications are also available from the American National Standards, Institute Inc., 1430 Broadway, New York, N.Y. 10018. The National Electrical Code is also available from the National Fire Protection Association, 470 Atlantic Ave., Boston, Mass. 02210. The Underwriters' Laboratories publication is also available from Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago, Ill. 60611. The IEEE publication may also be obtained from the Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, N.Y. 10017. Incorporation by reference provisions approved by the Director of the Federal Register on (date to be inserted prior to final rulemaking).

13. Subpart V is revised as follows:

Subpart V—Structural Erection

§ 77.3000 Structural erection; general.

The following requirements shall apply when structural erection is undertaken:

(a) Wood planking shall be of proper thickness to carry the working load, but shall be not less than 2 inches thick, full size, undressed planking; or ¾ inch thick exterior grade plywood; or equivalent material.

(b) Metal decking of sufficient strength shall be laid tight and secured to prevent movement.

(c) Planks shall overlap the bearing of each end by a minimum of 12 inches.

(d) Wire mesh, exterior plywood, or equivalent material shall be used and fit tightly around columns where plants do not fit tightly.

(e) Provisions shall be made to secure temporary flooring against displacement.

(f) Where safety belts are used, they shall be so connected to limit the free fall to six feet or less.

(g) Safety nets shall be hung with sufficient clearance to prevent user's contact with surfaces or structures below.

§ 77.3001 Steel erection; flooring requirements.

(a) *Permanent flooring—skeleton steel construction in tiered buildings.* (1) Permanent floors shall be installed as the erection of structural members progresses, and there shall be not more than eight stories between the erection floor and the uppermost permanent floor, except where the structural integrity is maintained as a result of the design.

(2) At no time shall there be more than four floors or 48 feet of unfinished bolting or welding above the foundation or uppermost permanently secured floor.

(b) *Temporary flooring—skeleton steel construction in tiered buildings.* (1) (i) The derrick or erection floor shall be solidly planked or decked over its entire surface except for access openings. Planking or decking of equivalent strength, shall be of proper thickness to carry the working load.

(ii) On buildings or structures not adaptable to temporary floors, and where scaffolds are not used, safety nets shall be installed and maintained whenever the potential fall distance exceeds two stories or 25 feet.

(ii) A safety railing of ½-inch wire rope or equivalent shall be installed, approximately 42 inches high, around the periphery of all temporary-planked or temporary metal-decked floors of tier buildings and other multifloored structures during structural steel assembly.

(2) Where erection is being done by means of a crane operating on the ground, a tight and substantial floor shall be maintained within two stories or 25 feet, whichever is less, below and directly under that portion of each tier of beams on which bolting, riveting, welding, or painting is being done, except on structures where no flooring is intended or planned and safety belts, safety nets, or scaffolds are used.

(c) *Flooring—other construction.* (1) In the erection of a building having double wood floor construction, the rough flooring shall be completed as the building progresses, including the tier below the one on which floor joists are being installed.

(2) For single wood floor or other flooring systems, the floor immediately below the story where the floor joists are being installed shall be kept planked or decked over.

§ 77.3001-1 Structural steel assembly.

(a) During the final placing of solid web structural members, the load shall not be released from the hoisting line until the members are safely secured.

(b) Open-web steel joists shall not be placed on any structural steel framework unless such framework is safely bolted or welded.

(c) In steel framing, where bar joists are utilized and columns are not framed in at lease two directions with structural steel members, a bar joist shall be field-bolted at columns or the equivalent to provide lateral stability during construction.

(d) Where long span joists or trusses, 40 feet or longer, are used, a center row of bolted or welded bridging shall be installed to provide lateral stability during construction.

(e) No load shall be placed on open-web steel joists until the requirements of this section are met.

(f) Loads that need to be controlled shall be controlled safely by the use of tag lines, guides, or equivalent.

§ 77.3001-2 Steel erection; bolting, riveting, fitting-up and plumbing-up.

(a) Containers shall be provided for storing or carrying rivets, bolts and drift pins and shall be secured against accidental displacement when aloft.

(b) When bolts or drifts pins are being knocked out, means shall be provided to keep them from falling where the possibility of injury exists.

(c) Riveting shall not be done in the vicinity of combustible or flammable material unless precautions are taken to prevent fire and explosion.

(d) When rivet heads are knocked off or backed out, means shall be provided to prevent them from falling where the possibility of injury exists.

(e) Connections used in plumbing-up equipment shall be properly secured.

(1) The turnbuckles shall be secured to prevent unwinding while under stress.

(2) Equipment related to plumbing-up guys shall be placed in a manner that will enable persons to get at the connection points.

(3) Plumbing-up guys shall be removed only under the supervision of a person experienced in performing such work.

§ 77.3002 Concrete, concrete forms and shoring; general.

(a) Persons working more than 6 feet above any adjacent working surfaces, placing and tying reinforcing steel shall be provided with a safety belt, or equivalent device.

(b) Persons shall not be permitted to work above vertically protruding reinforcing steel unless it has been protected to eliminate the hazard of impalement.

(c) Reinforcing steel for walls, piers, columns and similar vertical structures shall be guyed and supported to prevent collapse.

(d) Wire mesh rolls shall be secured at each end to prevent recoiling action.

(e) Bulk storage bins, containers or silos shall have conical or tapered bottoms with mechanical or pneumatic means of starting the flow of material.

(f) Concrete mixers equipped with 1 yard or larger loading skips shall be equipped with a mechanical device to clear the skip of material.

(g) Handles on bull floats, used where they may contact energized electrical conductors, shall be constructed of nonconductive material or insulated with a nonconductive sheath whose electrical and mechanical characteristics provide the equivalent protection of a handle constructed of noncorrective material.

(h) Pumpcrete or similar systems using discharge pipes shall be provided with pipe supports designed for 100 percent overload unless the pipe is laying on the ground.

(i) Concrete buckets equipped with hydraulic or pneumatically operated gates shall have positive safety latches or similar safety devices installed to prevent accidental opening of the gates.

(j) Persons shall not ride concrete buckets.

(k) When discharging concrete on a slope, the wheels of ready-mixed trucks shall be blocked and the brakes set to prevent movement.

(l) The sills for shoring shall be sound, rigid, and capable of carrying the maximum intended load.

(m) All shoring equipment shall be inspected prior to erection. Any equipment found to be damaged shall not be used for shoring.

(n) Erected shoring equipment shall be inspected immediately prior to, during, and immediately after the placement of concrete. Any shoring equipment that is found to be damaged or weakened shall be immediately reinforced or reshored to original strength.

(o) Reshoring shall be provided when necessary to safely support slabs and beams after stripping, or where such members are subjected to super-imposed loads.

(p) *Metal tubular frames.* (1) Metal tubular frames used for shoring shall not be loaded beyond the safe working load recommended by the manufacturer.

(2) All locking devices on frames and braces shall be in good working order; coupling pins shall align the frame or panel legs; pivoted cross braces shall have their center pivot in place; and all components shall be in a condition similar to that of original manufacture.

(3) Devices for attaching the external lateral-stability bracing shall be securely fastened to the legs of the shoring frames.

(q) Formwork and shoring shall be designed, erected, supported, braced, and maintained so that it will safely support all vertical and lateral loads.

(r) In all areas in which persons are expected to work or pass, stripped forms and shoring shall be stockpiled promptly after stripping. Protruding nails, wire ties, and other form accessories not necessary to subsequent work, shall be pulled, cut, or other means taken to eliminate any hazard.

(s) Imposition of any construction loads on the partially completed structure shall not be permitted unless such loading has been considered in the design and has been approved by the engineer-architect.

§ 77.3002–1 Forms and shoring.

(a) *Vertical slip forms.* (1) The steel rods or pipe on which the jacks climb or by which forms are lifted shall be specifically designed for the purpose. Such rods shall be adequately braced where not encased in concrete.

(2) Jacks and vertical supports shall be positioned in a manner that the vertical loads are distributed equally and do not exceed the capacity of the jacks.

(3) The jacks or other lifting devices shall be provided with mechanical dogs or other automatic holding devices to provide protection in case of failure of the power supply or the lifting mechanism.

(4) Lifting shall proceed steadily and uniformly and shall not exceed the predetermined safe rate of lift.

(5) Lateral and diagonal bracing of the forms shall be provided to prevent excessive distortion of the structure during the lifting operation.

(6) During lifting operations, the form structure shall be maintained in line and plumb.

(7) All vertical lift forms shall be provided with scaffolding or work platforms completely encircling the area of placement.

(b) *Tubed and coupler shoring.* (1) Couplers (clamps) shall not be used if they are deformed, broken, or have defective or missing threads on bolts or other defects.

(2) The material used for the coupler (clamp) shall be of a structural type, such as drop-forged steel, malleable iron, or structural grade aluminum. Gray cast iron shall not be used.

(3) When checking the erected shoring towers with a shoring layout, the spacing between posts shall not exceed that shown on the layout, and all interlocking of tubular members and tightness of couplers shall be checked.

(4) All baseplates, shore heads, extension devices, or adjustment screws shall be in firm contact with the footing sill and the form material and shall be snug against the posts.

(c) *Single post shore.* (1) For stability, single post shores shall be horizontally braced in both the longitudinal and transverse directions, and diagonal bracing shall also be installed. Such bracing shall be installed as the shores are being erected.

(2) All baseplates or shore heads of single post shores shall be in firm contact with the footing sill and the form materials.

(3) Whenever single post shores are used in more than one tier, the layout shall be designed and inspected by a structural engineer.

(4) when formwork is at an angle, or sloping, or when the surface shored is sloping, the shoring shall be designed and built for such loading.

(5) Adjustments of single post shores to raise formwork shall not be made after concrete is in place.

(6) All nails used to secure bracing or adjustable timber single-post shores shall be driven home and the nail clinched if its protrudes through.

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